Municipal and County Engineering

DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF ALL PUBLIC WORKS

Vol. LXIX. AUGUST, 1925 No. 2

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Contracts Awarded

ROADS AND STREETS

Ala., Montgomery—Nixon & Phillips, Lineville, awarded contract by State Hwy. Dept. for grading and gravel surfacing 13.88 miles State Proj. 20, Lama Co., at $150,049.

Cal., Los Angeles—Geo. H. Oswald, 366 E. 58th St. awarded contract by County at $28,910.98 for impvt. of Market St., Western to Normandie Aves. Following awards made by Board of Pub. Works: Warren Constr. Co. 2221 E. 25th St. contr. for impvt. of Occidental Blvd., at $101,856.95 involving conc. pave., Warrenite-bitulithic pave., walk, etc.; J. D. Phillips, 208 San Fernando Bldg. contract for improvement of Elm St. Cypress Ave. to San Fernando Rd. at $2,662.15; Dunn St., Upland Ave. to Crestwood St., let to McCray Co., 416 American Bank Bldg. at $62,600; Norton Ave., to F. E. Low, 750 S. Figueroa St. at $7,493, conc. pave. etc.; Meridian St., Annandale Blvd. to Neva Pl. to Hall-Hohnson Co., 3025 Fowler St., at $10,538; asph. conc. pave., oiled rdway, etc.; Galveston St., Portia to McDuff Sts. to F. E. Low, 750 S. Figueroa St. at $5660; conc. pave., oiled rdway, etc.; 85th St. Figueroa to Hoover Sts. to Geo. H. Oswald, 366 E. 58th St. at $12,745.

Cal., Sacramento—Following contracts let for highway work by State Hwy. Comn.: Nevada and Sierra Cos. 6.6 mi. betw. Floriston and Nevada State line, Nevada and Sierra Counties, to Nevada Contracting Co. Fallon, Nev., at $313,087.50; Sonoma Co. 8.8 miles hwy, betw. Healdsburg and Mark West Crk. brdg., 8.6 miles to be conc. pave., 1.2 mi. to be gravel or broken stone, to Galbraith & Janes, P. O. Box 539, Napa, at $278,466; Tehama Co. 1 mile conc, pave, thru City of Corning, to E. A. Burns, Stockton, at $36,922; Merced Co. involving crush. gravel or stone should. 10 miles betw. 6 mi. east of Los Banos and San Joaquin Riv., to Kaiser Paving Co. Am. Bank Bldg., Oakland, at $23,368; Monterey Co. betw. 1 mile no. of Bradley and San Lucas Ave., 23.1 miles to be widened with waterbound macadam should. to F. W. Nighbert, Bakersfield; Placer Co. 11.6 miles broken stone or gravel surf. from Tahoe City to Nev. State line to Bishop & Brooks, Hagelstein Bldg. Sacramento, at $23,912.

Cal., San Diego—Phoenix-Tempe Stone Co. Phoenix, Ariz. award. contract for paving Voltaire St. Bacon and other streets, at $81,047.47; Hazard Contr. Co. 302 5th St. awarded contract at $41,-079 for paving 4th St., A to K Sts.

Fla. Haines City—Pryor & McLeod, Haines City, awarded contr. at $290,000 for street paving.

Fla., Lakeland—J. G. Yates Co. and Stedman & Hughes, awarded contract by City Comn. for 3 in. brick street pavement here, at $233,541.

Fla. Tallahassee—Following contracts let by State Rd. Dept: 7 mi. grading Rd. 8, Okeechobee City to Lake Anne, to Otis Hardin, Okeechobee, at $15,200; 6.79 mi. rock base Rd. 3, Lawtey to Maxwell to Whitney Constr. Co., St. Augustine; 5.17 mi. grading and draing. Rd. No. 5, so. of High Springs, to Taylor & Co. Lincoln Life Bldg., Birmingham, Ala. at $21,500; 10.89 mi. grading and draing. Rd. No. 5 no. of Archer, to J. R. and J. B. Miller, Baconton, Ga., at $44,693; 9.92 miles rock base Rd. No. 3 betw. Deland and St. John River, to L. M. Gray, Oak Hill, Fla., at $138,270; 13 miles rock base Rd. No. 8, Okeechobee to Lake Anne to H. E. Wolfe, at $141,921; approach to Blackwater River brdg. Rd. No. 1, Santa Rosa Co. to S. G. Collins, Milton, Fla., at $14,700; 3.5 mi. sheet asph. Rd. No. 2, Leesburg to Helena Run, to Southern Paving Constr. Co. Volunteer Life Bldg., Chattanooga, at $150,313; 9.67 mi. grading, etc. Rd. 1 east of Chattahoochee to Taylor Contracting Co. Birmingham, at $55,524; 9.83 miles grading, etc. Rd. 1, west of Quincy, to Taylor Constr. Co. at $34,531; 10.82 miles grading, etc. Rd. 3, bet. Palatka and Clay Co. line, to B. Booth & Co. Green Cove Springs at $60,764.

Fla., Tampa—Geo. E. Wycoff & Co. Hall Bldg., Little Rock, awarded contract to pave 47 streets in Bel Mar Subdiv., Hillsborough Co., at $300,000.

Ga., East Point—Following contracts let by State Hwy. Dept.: Bryan Co. 2.3 miles shell or gravel surf. on Bryan Co. 2.3 mi. or gravel surf. on Bryan Co. Causeway, Gibson Constr. Co., Savannah, Ga. at $27,225; brdg. over Satilla River betw. Atkinson and Lulaton, Waycross-Brunswick rd. to Austin Bros. Bridge Co. Mickleberry St., Atlanta, at $77,915; Chattahoochee Co. 3 mi. gravel surf. Cusseta, Columbus, Campbell Constr. Co. Columbus, at $7,500; Decatur Co. double leaf filled rolling span, complete for bridge over Flint River, to Atlantic Bridge Co., Boxley Bldge. Roanoke at $45,-860; Thomas Co. 17.72 mi, surf. treated Thomasville-Quitman, to Parker Constr. Co. Chattanooga, Tenn. at $58,656; Ware Co. 7 miles Waycross-Folkston rd. to Sam E. Finley Co. Atlanta, at $24,-968.

Ill., Decatur—Birt & Driscoll, awarded contract for West Locust St. at $10,485.75; Orchard St., $64.-075.90 and Maffit St. at $46,824.20.

Ill., Evanston—Board of Local Improvements let following contracts: Main St. paving, Florence Ave. to City limits to Jno. McGarry Co., Chicago, at $101,628; 3 alley paving contracts to M. Foley & Co. Evanston, at $14,000; also contract for widening Chicago Ave., Main to Kedzie St. at $9,200.

Ill., Brookfield—Jno. Mackler Co. awarded contract for paving Park Ave., at $15,699; also contract for South End paving, at $158,467.20; Sternberg-Powell Co. contract for Brookfield Ave. paving at $22,594.

Maine, Augusta—State Highway Commission let contracts for conc. and bitum. macadam surf, on 3.77 mi. hwy. in York, to Bruno & Petitti, 18 Tremont St. Boston, at $203,727; bitum. macadam surf. on 2.87 miles hwy, in Windham and Raymond, to Ford & Smiley, Skowhegan, Me., at $74,376.

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Mass., Boston—J. C. Coleman & Sons Co., 1620 Tremont St., Roxbury, awarded contract by Dept. Public Wks. for sheet asph. of bitulithic paving on Riverway Rds. at $60,610; Warren Bros. Co., 9 Cambridge St., awarded contract for bitulithic paving on Columbia Rd., Dorchester, at $66,968.

Mich., Lansing—Following Federal Aid contracts let week ending July 4: Rd. 67 A-1 and A-2, Washtenaw Co. Pittsfield Twp. Cl. 7 in. F-Std. 20-24 ft. wide, A-1, (0.658), A-2, (2.020) miles, to State Construction, at $74,894.72 (est. cost cement, $29,-428.32); 82-B, (Non T. L.) Washtenaw Co., Ann Arbor and Superior Twps. Cl. 7-in. F-Std. 20 ft. wide (9.939) miles, State Construction, at $190,717 (cement $81,338.58); Rd. No. 95 D, Lenawee and Washtenaw Cos. Franklin, Cambridge, Woodstock and Manchester Twps. Cl 7-in. F-Std. 20 ft. wide (13.953) miles to State Construction, at $321,638.72 (cement, $109,925.88); 95 E. Lenawee Co. Woodstock Twp. Cl 7-in. F-Std, 20 ft. wide, 0.246 mi. to State Construction at $8,973.33 (cement $1,888.51); 95 F, Lenawee Co. Woodstock Twp. Cl. 7 in. F-Std. 20 ft. wide, (1,755 miles) to State Construction, at $36,287.71); (cement $12,925); 146-A, T. L. 14, Ingham Co. Delhi Twp. Cl 7 in. F-01. 20 ft. wide, 0.871 mi. to State Construction, at $36,088.44 (cement, $13,354.).

Mo., Farmington—W. E. Larnegan, awarded contract by St. Francois Co. Court for 3.03 miles 18-ft. conc. rd. from top of Federal Hill thru Flat River and St. Francois to Desloge, at $95,000.

Neb., Havelock—Abel Constr. Co. 318 Terminal Bldg. Lincoln, awarded contract for paving in Dist. 11 and Dist. 10, at $100,000.

N. H., Concord—Following contracts let by State Highway Comn: A. D. Bridges, Hazardville, Ct., awarded contracts at $36,590 and $64,659, respectively, for bitum. macadam pavement on 1.53 miles in Rindge and 5.03 miles in Hinsdale; P. C. Ricci, Burlington, Vermont, contract at $38,237 for 1.33 miles of hwy. in Westmoreland; gravel surf. on 0.9 miles hwy. in Canaan to Arborio Road Construction Co., 408 Main St. Hartford, Ct., at $30,090 and 1.8 miles hwy. in Chester to T. Watkins, Amesbury, Mass., at $22,487.

N. J., Trenton—Korp & Korp, Phillipsburg, awarded contract for rein, conc, paving; 51,915 sq-yds. Ringoes-Flemington Rd. at $251,910.

N. C., Elizabeth City—D. E. and Lee Williams, South Mills, or Eliz. City, N. C. awarded contract by Pasquotank Comn., for about 5¼ miles 9-ft. 8-6-8-conc. road, at $100,000.

Okla., Blackwell—O. T. Tyler, awarded contract for brick and conc. pavement in St. Impvt. Dist. 28, at $130,000.

Okla., Okla. City—State Hwy. Dept. Okla. City, let following contracts: Grading, conc. pavement, etc. (32,998 sq. yds.) Garbor Rd. to Hyde Constr. Co. Am. Bank Bldg., Enid, at $81,027; vert. fibre brick pavement (32,367 sq. yds.) So. Harrah Rd., Okla. Co., to Green-Beekman Co. 519 W. Main St. Okla. City, at $86,337; grading, etc. 6 miles F. A. P. 174-A to Gibson & Mitchell, Pauls Valley, at $37,-569; 5.39 mi. F. A. P. 174-B, to S. W. Constr. Co., Ardmore, at $34,400.

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Ore., Salem—Following contracts let by State Highway Commission: Baker Co. Sag-Halfway sec. of Baker-Cornucopia hwy., 3.2 miles surfacing to A. D. Kern, at $14,010; Josephine Co.-O'Brien School House-George ranch section of Redwood-Oregon Caves Hwy., 20.42 miles, gravel surf. to Joslyn & McAllister, at $89,240; 4.32 mi. grading Redwood Junction-Wells ranch sect., at $25,000 to J. C. Kinkaid; Klamath Co., Bly Mountain- Beatty sec. Klamath Falls-Lakeview Hwy., 13.45 mi. grading to J. T. Logan, at $121,997; grading 13.36 mi. Deschutes Co. line-Crescent section of The Dalles-California hwy. to Newport Constr. Co., at $22,-470. Resurfacing 18 miles Klamath Falls-Modoc point sect. of The Dalles-California Hwy. to Dunn & Baker, at $57,392; Malheur Co. Beam Creek-Lost Valley, John Day Hwy. to Ed. Drummir, at $96,-325; Baker Co. surf. 3.8 miles Middle bridge-Love Bridge sec. Cornucopia Hwy. to Triangle Const. Co., at $19,990; Coos Co. resurfacing 8.4 mi. Coquille-Myrtle point sec. Roseburg-Coos Bay Hwy. to A. B. Gridley, at $43,505; Umatilla Co. Emigrant Hill sec. Old Oregon Trail, resurfacing 16.7 miles to A. D. Kern, at $52,867.

Penn., Harrisburg—Dept. of Hwys. let contr. for grading and rein. conc. paving—19,920 sq. yds. Rte. 20, Old Lycoming Loyalsock Twp. Rd. Lycoming Co. to A. W. Hinaman, Somerset, at $100,632; grading and conc. paving, 52,100 sq. yds. Appl. 2696, Upper-Lower Pottsgrove-New Hanover Twp. Rd., Montgomery Co. to Souder Constr. Co., Woolworth Bldg, Lancaster, at $203,231.

Pa., Philadelphia—Bureau of Highways & Dept. Public Works, let following contracts: Grade Ash, Bath and Buckius Streets, to Garlick Bros. 2948 East Venango St., at $5,706; grade Dicks St. at $5,853, to T. P. Lee, 5629 Cherry St., to F. B. Wenner, 2313 Walnut St. Ithan and 57th Sts. at $24,318, Stenton St., $560; Stange Constr. Co., Broad & Locust Sts., Pattison St., $414,278; Eastern Asphalt Co. 1504 Penn. Bldg. asph. pave., Albanus St., at $11,308, Emlen St. $7,652, Glenlock St. $3,196, Hunting Park, $45,306, Sedgley St., $9,-833; Mack Paving and Construction Co. Nicetown Lane & Luzerne St., grade Naomi St., at $4,798; Barber Asphalt Co. 239 N. 30th St., grade Haines St. at $66,799, Hunting Pk., $23,726, Lebanon St., $25,706, Locust and Pine Sts., $13,960, Janney, and others at $16,853 to Union Paving Co. 30th & Locust Sts., Boyer, Blakemore, Horter Cts., at $39,295; B. Foster Co., Inc. 20th & Venango, country rd. impvt. Brewster, Crothers and others, at $29,823, to J. Devlin, Jr. Hancock & Tompson Sts., Ellet St. at $3,989, A. S. Altemus, 1808 Chestnut St. Hampton St. $2,794; Municipal Paving Co. 792 Catherine St., redressed granite blk, repave. Columbia St., at $14,947; Acchione & Canuso Paving Co., 804 S. 12th St., Reed St., at $28,651, to Mazzola & Marino, 739 S. 7th St., 16th St., at $40,-032.

Pa., Pittsburgh—Following contracts let for road impvts. in Allegheny County: Rein. conc. paving, 4650 ft. Squaw Run Rte. A. O'Hara, Twp. to D. W. Challis & Sons, Inc. Sewickley, at $74,981; 8784 ft. Baldwin Rd. Robinson Twp. to McPherson Bros. 421 Chestnut St. Sewickley, at $141,333; grading and rein, conc, paving, 12,032 ft. McMurray Rd. Bethel Twp. to Matthews Bros. Constr. Co., Pittsburgh at $120,934.

R. I., Providence—A. D. Bridges, Hazardville, Conn. awarded contract by State Board of Public Works, Providence, for reinf. conc. pavement on Tower Hill Rd. and No. and So. Kingston, F. A. P. No. 9; 7.69 miles, at $388,025.

S. Car., Charleston—Simons-Mayrant Co. 39 Broad St. Charleston, awarded contract for 3.40 miles sheet asph. on State Rte. No. 2, at $160,259.

S. C., Georgetown—Simons-Mayrant Co. Charleston, awarded contr. by City for sidewalks and gutter, at $34,625; Ely Construction Co. Lamar Bldg. Augusta, Ga. awarded contract for paving at $83,-687.

Tex., Groesbeck—Brammer & Wilder, Stewart Bldg. Houston, awarded contract for 13 lateral

roads, totaling 40 miles, near Mexia; 20 miles gravel and 20 miles asphalt, at $357,717.

Texas, Port Arthur—Smith Bros. Inc., Santa Fe Bldg., Dallas, contract by City to pave streets with 2½ in. sheet asphalt on concrete base, at $393,129.

Tex., Wichita Falls—L. E. Whitman & Co. Morgan Bldg., awarded contract to concrete 4 miles road at $126,000.

Vt., Montpelier—O. J. Keating, Fitchburg, Mass. awarded contr. for impvt. of Pownal F. A. P. No. 73A, at $104,558.70.

Vt., Pownal—Highway Commission, Montpelier, let contr. for pavement (concrete) on 2.2 miles of highway here to P. J. Keating Co. 280 Main St., Fitchburg, Mass., at about $104,558.

W. Va., Philippi—Contract for grading and bitum. macadam paving, etc. on 3 miles Taylors Drain Clemtown Proj. 9 let to Marara & Albright, Albright, at $67,988; 2 miles Bear Bailey Rd. Proj. 1, to Williams & Rhoades, Elkins, at $44,321; 4 miles Philip Rd. Proj. 10, to J. L. Holbert & Sons, Shinnston, at $100,445.

SEWERAGE AND SEWAGE TREATMENT

Cal., Hermosa Beach—B. C. Nichols, 1216 Manhattan Ave. Manhattan Beach, awarded contract by City for constr. of sewer in various City streets, etc. at $187,945.

Cal., Los Angeles—R. E. Cooney, 241 S. Norton, awarded contract by Board of Public Works at $187,000 for construction of Sec. 22 of No. Outfall sewer.

Cal., Porterville—H. A. Teget, 222 Harvard Pl., Ontario, awarded contract by City for constr. of sewage disp. plant at $43,330.60.

Ill., Pittsfield—V. E. Taylor, 407 Washington Ave., St. Louis, Mo., awarded contract by Bd. of Local Impvts. for 46,904 ft. 8-18 inch vitr. clay and 84 ft. 8-18 in. cast iron sewers in various sts., at $60,992.

Ill., Wheaton—W. J. Newman & Co., 23 N. Curtis St., Chicago, Ill., awarded contract by Wheaton San. Dist. at $129,500.

Md., Baltimore—N. Martell, 417 S. Eden St. Baltimore, award. contract for 30,300 lin. ft. 8-in. vitr. sewer, 11,900 lin, ft. 5 and 6 inch house constructions, etc. in Sewer Dist. H-6-2, Contract 218, at $102,851.

N. H., Manchester—T. G. Jewett, Jr., Inc., 35 7th St. New Bedford, awarded contract for completing constr. and installing for city Beach St. intercepting drain, includg. branch drain and appurts., at $114,968.

N. Y., New York—Knight & DeMicco, Inc., 448 S. Tremont Ave. awarded contract for sewers in Allerton Ave., at $19,815; Duncan St., to M. Del Balso, 660 E. 221st St., at $108,441.

N. C., Burnsville—Higgins & Co. Charlotte, awarded contract for constr. of water works system including double outlet system of sewerage; 11 miles pipe lines.

N. Dak., Dickinson—Haggart Constr. Co., 214 Roberts St., Fargo, awarded contract for constr. of storm sewer system, at $74,000.

N. Dak., Fargo—Haggart Constr. Co., 214 Roberts St., Fargo, for segment blk, trunk sewer thru No. Fargo and Campus of N. D. Agricultural College, at $102,779.

Ohio, Akron—E. & W. McShaffrey, 574 Rhodes Ave., awarded contract for rebldg. 1700 ft. 12-15 in. vitr. clay and 4,350 ft. 30-63 in. brick sewer prelim, to abolishing grade crossings at Buchtel Ave. and Exchange St. Contr. 1, at $118,995.

Ohio, Euclid—A. C. Hattendorof, Stop 14, Euclid Ave. award. contract for sewers in Sec. 1, Babbitt Rd., at $27,544; Sec. 2, to Curro & Whittaker, 12208 Mayfield Rd. Cleveland, at $27,741; conc. sewers in Cut and Chardon Rds. to Curro & Whittaker, 12208 Mayfield Rd., Cleveland, at $57,-104.

Ohio, Cleveland—Gallagher-Burke Co., 1223 Bonnieview Ave., Lakewood, awarded contract for laying 5,500 ft. 8 to 60 inch vitr. clay sewers in Wagar Rd. Impvt. No. 600, at $66,648; Winterbottom-Connelly Co. 1406 W. 25th St. awarded contr. for 21,000 ft. 8 to 27 inch vit. clay sewer in Chestnut Hill Dr. Impvt. No. 71, at $83,508. N. Carroccio, 14109 Benwood Ave. awarded contract for 7,000 ft. 8-48 inch conc. sewer in Ridgeway Blvd., at $64,230.

Ohio, Cincinnati—Following contracts let; 1, 165,-626 ft. 6-12 inch vitr. clay sewer in Sched. A, and 2-sedimentation tanks and filter plant, Sched. B, in Sewer 3, Dist. 2 (Mt. Healthy, North College Hill and Steele's subdiv.) to Hammon Constr. Co., 4612 Woodward St., Detroit, Mich., (1) $421,743, to F. Franz, Cincinnati Ave., North Bend, (2) $130,552.

Pa., Gettysburg—H. C. Brooks, Martinsburg, W. Va. awarded contract by Boro. Council Chamber for sewage disposal plant, outfall sewer and Imhoff tanks, at $49,950.

Tenn., Dayton—J. B. McCrary Co. Citizens & S. Bank Bldg., Atlanta, Ga. awarded contract for sewerage system at abt. $50,000.

Tenn., Knoxville—Fisher & Calloway, Lenoir City, awarded contract for constr. of Lonsdale Trunk sewer, (conc) at $53,048.

Tex., Lufkin—J. S. Moore & Son, awarded contract for impvts., for sewage disp. plant, at $73,-362.

Tex., Port Arthur—Chas K. Horton & Co., 2202 Clay St., Houston, awarded contract for storm sewers and Shreveport ditch, at $160,514.

WATER SUPPLY AND PURIFICATION

Ala., Tuscaloosa—M. I. Weddell awarded contract by City to construct filter plant at $45,000.

Cal., Burbank—Geo. A. Simpson, Olson Bldg., Burbank, awarded contract by City for approx. 15,000 ft. 41-in. 6-in. and 8-in. water mains in Ban Mar Hills Tr., at $69,000.

Ill., Carthage—Johnston Contruction Co., Waterloo, Iowa, awarded contract for constr. of water works system here, at $127,570.

Ill., West Frankfort—Katz Construction Co. awarded contract for constr. of water works system at $550,000.

Ill., White Hall—C. M. Hanes, awarded contract by City Council for constr. of new water works at $200,000.

Md., Baltimore—J. H. Miller, Eutaw & Franklin Sts., awarded contract by Bd. of Awards for superstruct. of chem. filter bldgs. pumping station, garage, shelter and control chamber for Montebello filters, Hartford Rd. and 33rd Sts., at $309,-631.

Mass, Boston—C and R Construction Co. awarded contract for laying 48-inch water pipe in Commonwealth Ave.. Mass. Ave. to Arlington St., in Public Garden, in and across Charles St. and in Boston Common, city proper, at $135,260.

N. C., Burnsville—V. B. Higgins & Co., Park Road, Charlotte, contract for water works plant consisting of approx. 3 miles 6-in. cast iron gravity line; also 3 miles 6-in. distribution mains with fire protection, 500,000 gal. filtration plant, 200,000 gal. conc. clear well, etc.

Ohio, Cincinnati—W. Hennigan, 7011 Montgomery Pk., Norwood, awarded contract by Hamilton Co. for 22,760 ft. 6 and 8 inch cast iron mains in Water Supply Line 12, Dist. 4, School Sec. Rd. Harrison and Race Aves. and 22,494 ft. 6 and 8 inch mains in Water Supply Line 11, Dist. 4 and 5, Muddy Crk. Anderson Ferry and Foley Rds. to W. Hennigan, 7011 Montgomery Park, Norwood, at $45,109 and $44,675, respectively; 41,384 ft. 6 and 8 in. mains in Water Supply Line 19, Dist 1, Osceola Park, Maderia Hts. and Drake Rd. to J. Dempsey, 5310 Carthage Ave., Norwood, at $76,237.

S. Car., Greenville—City let following contracts for water system: Pipe line to J. B. McCrary, Atlanta, Ga., at $283,002; dam to Rinehart & Dennis, Charlottesville, Va., at $624,566; valves to Grinnell Co. Charlotte, N. Car., at $11,296; cast iron pipe to U. S. Cast Iron Pipe and Foundry Co., Birmingham, Ala., at $17,000; Standard Cast Iron Pipe & Foundry Co. Box 992, Atlanta, Ga., for furnishing

6,200 tons 30-in and 42-in. classes C & D bell and spigot cast iron water pipe at over $250,000; B. Nicoll & Co., 294 Madison Ave., New York, for lock bar steel pipe furnishings and laying to T. A. Gillespie, 5 Dey St. New York; dam will be 750 ft. long and 28 ft. wide; lake 2 miles long containing 500 acres; capy. 6,000,000,000 gals.

Va., Woodstock—Lynchburg Foundry Co., Peoples National Bank Bldg., Lynchburg, awarded contract for furnishing 56,500 ft. 8-in. cast iron pipe; Pace Constr. Co., 401 Mountain Tr. Bldg., Roanoke, contract for laying above pipe and constructing concrete intake dam. $115,000.

Wash, Aberdeen—Kennedy Bros. Aberdeen, awarded contract for constr. of City reservoir to be built at Fairview Heights, at $53,480.

Prospective Work

ROADS AND STREETS

Ala., Mobile—Mobile Co. Board of Revenue and Road Commrs. plan to pave 11.7 miles Old Spanish Trail, betw. Theodore and Grand Bay; also erect several conc. bridges. $119,000 available.

Ala., Tuscaloosa—Tuscaloosa County Bd. of Revenue plans paving County's part of Birmingham rd. Considering $300,00 bond issue.

B. C., Vancouver—Point Grey Municipal Council considering program calling for expendt. of approx. $450,000 for constr. of 3 large sewers and laying a large amount of hard surfacing in Shaughnessy Heights. Total of paving recommended is est. to cost $667,900, but only $267,000 required for immediate use.

Fla., Green Cove Sprgs.—Clay County plans road and bridge bldg.; $515,000 bonds voted.

Fla., Inverness—Citrus County Commrs. plan road bldg. Considering $1,000,000 bond election. Cons. Engrs., E. V. Camp & Associates.

Fla., Jacksonville—Duval County plans 7 roads. $1,500,000 bonds voted.

Fla., Miami—Dade Co. Special Rd. & Brdg. Dist. Nos. 2 and 3, plan Everglades Ave. causeway and 20 miles rds. Election Sept. 15th to vote on $975,000 bonds. Dist. No. 3, $675,000 and Dist No. 2, $300,000.

Fla., Mount Dora—Town planning to expend $460,000 for purpose of repaving streets and avenues.

Fla., W. Palm Beach—Palm Beach Co. Commrs. plan to widen and recondition Dixie Hwy. thru County; also build 2 or 3 bridges. Contemplate $600,000 bond issue.

Ill., Chicago—On Recommendation of Bd. Local Impvts. City Council has passed Ords. for paving and improving 103rd St., Halsted to Rock Isl. trks. and Sangamon St., 87th to 88th Sts. Ord. also passed for paving Marshfield Ave., 75th to 76th. Two recommendations for paving and improving Rogers Park streets passed by Council. Chase Ave., Sheridan east, with asphalt; alley from no. line Jonquil betw. Juneway, Sheridan and N. Ashland will be paved with cement. Ord. for paving alleys in blk. bounded by N. Ashland, N. Clark, Pratt and Farwell referred to Board. Many alleys and sewer improvements planned for so. sect. of City. Will include portions of Calumet Ave. Exchange, Yates, Jeffrey, W. 122nd St. etc. Devon Ave. betw. Sheridan Rd. and Kedzie will be widened as part of rd, bldg. program announced by Co. Bd. and to be financed by the $100,000,000 bond issue. Ashland will be widened from Devon to Pratt as also will Winemac, which is to be widened from lake west to City limits. Resolution passed by Bd. Local Impvts. for paving 87th St., starting at St. Lawrence Ave. This impvt. will cost $136,000. Sanitary Dist. of Chicago has passed Ord. providing for issuance of $5,000,000 in bonds for purpose of enlarging and bettering system of San. District.

Ill, Springfield—Six bills, including three which appropriate total of $136,000,000 for hard road constr., signed by Governor Small. Three senate bills all sponsored by Senator Meentz will provide $96,000,000 for paving work from recent $100,000,000 bond issue, $5,000,000 for acquisition of land containing rd, bldg. matls., and $35,000,000 from the $60,000,000 bond issue. Bill 63 reappropriates $96,000,000 from St. Rd. Fund of Dept. Pub. Rds., or as much as necessary for constr. of hard surf. rds. this yr. along designated routes as originally approved June 23, 1923. Bill 64 provides for appropriation of $5,000,000 dur. biennium commencing July 1, 1925, for carrying out provisions of an act approved June 28, 1921 authorizing Dept. Pub. Rds. to acquire prop, containg. rd. bldg. matls and to erect and operate plants to produce the matl. Bill 65 appropriates $6,000,000 for maint. of st. hyws. Bill 66 provides for appropriation of $35,000,000 from Rd. Fund of Dept. for period, July 1, 1924 to June 30, 1927, for constr. of hard surf. rds. throughout the United States approx. 24,000 miles of hwys. are to be constructed this year and about 250,000 miles of maintenance work carried on. It is estimated that there is about $495,000,000 available for constr. work and $165,000,00 for upkeep.

Ky., Jackson—Breathitt Co. plans completing links of Appalachian Way. $200,000 bonds voted.

Mo., Kansas City—City plans to expend $1,355,000 to improve No Penn Valley Park and Main Street, and to open Pershing Rd. to Penn. Ave.

Mont., Butte—City Council considering matter of street impvts. in Special Impvt. Dist. 326. Total est. cost of impvt. if Portland cem. conc., asph. conc. or bitulithic pavement is laid, is $167,914.69. Approx. cost of paving, grading and constructing draing. sys., if type of pave. is roadamite, Tarvia, penetration macadam, or similar type, is $92,700.17. Same is to be paid for by Special Impvt. Bonds or Warrants.

Nev., Carson City—Plans are being prepared on following projs; Hafed to Derby, Washoe Co. 16.00 miles grading; 90-C, Railroad Grade Sep. nr. Silver Zone, Elko Co. 4.00 mi. grav. surf.; North co. line to Schurz, Mineral co. 11.00 mi. grav. surf.; Co. line to Va. City (Geiger Grade) Storey Co. 5.5 miles grading; West County line to Hay Ranch, Eureka Co., 13.83 mi. grav. surf.; McGill to Mungerson Ranch 17.65 miles gravel surf. Lander Co.

N. C., Halifax—Halifax County Commrs. plan hard surfacing roads in County. $960,000 bonds authorized. Hon Wm. A. Hart, Dist. Hwy. Commr.

N. C., Raleigh—Wake County plans to extend Routes 21 and 50 south and southwest. Contemplates $1,100,000 bond election.

N. C., Wentworth—State Hwy Comn., Raleigh plans 12 miles hard surf, road from Virginia State line via Stoneville to Maynodan, Rockingham County.

Okla., Chickasha—State Hwy Commission, Okla. City, plans bldg. 80 mile state road and 40 miles county roads in Grady Co. $650,000 available. E. Bee Guthrey, Secy.

Okla., Tecumseh—Pottawatomie County Commrs. plan to surface 2 roads in County and improve lateral roads. Considering $700,000 bond election.

S. D., Sioux Falls—Contemplates paving entrances leading into Sioux Falls, W. 12th St. road, Minnesota Ave. rd. Dell Rapids rd., W. Soo Rd. E. 10th St. rd., Brandon rd. Will probably pave 5 miles with 20 ft. concrete at about $30,000 per mile this year. City Street Commr., Ellis O. Smith; Co. Hwy Commr. C. T. Charnock.

Texas, Anderson—Grimes Co. will receive bids about October 1st for 6.15 miles grading and draing. structures on State Hwy. No. 6 to Navasota River. Plans from Oscar A. Seward, Jr., Co. Engr., Navasota and State Hwy. Dept. Austin.

Tex., Anson—Jones County contemplates grading and bridging 2 roads: 15.27 mi. St. Hwy. No. 18, Stamford Rd. Dist., from Stamford to Shackleford Co. line, est. cost of which is $73,000; 17:80 miles St. Hwy. 93. Est. cost $46,000. Owen Thomas, County Judge. J. W. Puckett, Engr. Stamford.

Texas, Boston—Bowie County will receive bids

BUYERS' GUIDE

Aerial Tramways.
American Steel & Wire Co.

Air Lift Pumps.
Harris Air Pump Co.

Armor Plates.
Truscon Steel Co.

Asphalt.
Bitoslag Paving Co.
The Barrett Co.
Kentucky Rock Asphalt Co.
Pioneer Asphalt Co.
Standard Oil Co. (Indiana)
The Texas Co.
Uvalde Asphalt Paving Co.
Warren Asphalt Paving Co., The

Asphalt Filler.
The Barrett Co.
Bitoslag Paving Co.
Standard Oil Co. (Indiana)
The Texas Co.
Warren Bros. Co.

Asphalt Floors.
The Barrett Co.
The Texas Co.
Warren Bros. Co.

Asphalt Machinery.
Chausse Oil Burner Co.
Cummer & Son Co., The F. D.

Asphalt Plants.
Austin Machinery Corporation.
Cummer & Son Co., The F. D.
Littleford Brothers.
Warren Bros. Co.

Asphalt Railroad Plants
Cummer & Son Co., The F. D.
Warren Bros. Co.

Asphalt Tools.
Chausse Oil Burner Co.
Littleford Brothers.
Warren Bros. Co.

Asphalt Tool Wagons.
Chausse Oil Burner Co.
Littleford Brothers.

Auto Fire Apparatus.
Kissel Motor Car Co.
International Motor Co.
Pierce-Arrow Motor Car Co.

Automobiles.
Ford Motor Co.

Back Fillers.
Austin Machinery Corporation.
Pawling & Harnischfeger.

Bar Cutters and Benders.
Koehring Co.

Bars, Reinforcing.
Truscon Steel Co.

Binders, Road.
The Barrett Co.
Pioneer Asphalt Co.
Standard Oil Co. (Indiana)
The Texas Co.
Uvalde Asphalt Paving Co.
Warren Bros. Co.

Bitulithic Pavements.
Warren Bros. Co.

Blasting Accessories.
E. I. du Pont de Nemours & Co., Inc.

Blasting Powder.
E. I. du Pont de Nemours & Co., Inc.

Bodies.
Lee Trailer and Body Co.
Littleford Brothers.

Braces, Extension.
Kalamazoo Fdy. & Machine Co.

Brick Rattlers.
Olsen & Co., Tinius.

Brick-Testing Machinery.
Tinius Olsen Testing Mach. Co.

Brick, Paving.
National Paving Brick Mfrs. Assn.

Bridges.
Luten, Daniel B.

Buckets, Dredging, Excavating and Sewer.
Pawling & Harnischfeger.

Buckets, Dumping
Littleford Brothers.
Pawling & Harnischfeger

Cableway Accessories.
Sauerman Bros.

Cableway Excavators.
Sauerman Bros.

Calculators.
Kolesch & Co.

Car Unloaders.
Austin Machinery Corporation.
Heltzel Steel Form & Iron Co.

Castings.
U. S. Cast Iron Pipe & Fdy. Co.

Cast Iron Pipe.
U. S. Cast Iron Pipe & Fdy. Co.

Catchbasins.
Dee Co., Wm. E.
Madison Foundry Co.

Cement Gun Work.
Indiana Gunite & Const. Co.

Cement Testing.
Chicago Paving Laboratory.
Flood & Co., Walter H.
Howard, J. W.
Hunt Co., Robert W.
Indianapolis Paving Laboratory.
Van Trump, Isaac.

Cement Testing Machinery.
Tinius Olsen Testing Mach. Co.

Central Heating Plants.
American District Steam Co.

Chemists, Engineering
Chicago Paving Laboratory.
Dow & Smith.
Flood & Co., Walter H.
Howard, J. W.
Hunt Co., Robert W.
Indianapolis Paving Laboratory.
Van Trump, Isaac.

Chimneys, Concrete.
Truscon Steel Co.

Chimneys, Steel.
Littleford Brothers.

Chloride of Lime.
Pennsylvania Salt Mfg. Co.

Clay Pipe, Vitrified.
Clay Products Assn.

Clay Products.
Clay Products Assn.

Concrete Bridges.
Luten, Daniel B.

Concrete Mixers.
Austin Machinery Corporation.
Koehring Co.
Smith Co., T. L., The

Concrete, Reinforcement.
American Steel & Wire Co.
Truscon Steel Co.

Conduits.
Canneiton Sewer Pipe Co.
Carey Co., Philip, The.
Rosing, Inc., Astrid S.
Truscon Steel Co.

Conduit Rods.
Stewart, W. H.

Consulting Engineers.
Alvord, Burdick & Howson.
Artingstall, Wm.
Brossman, Chas.
Burd & Giffels.
Chicago Paving Laboratory.
City Wastes Disposal Co.
Dow & Smith.
Druar & Milinowski.
Flood, Walter H., & Co.
Howard, J. W.
Hunt Co., Robert W.
Indianapolis Paving Laboratory.
Jones, Sam L.
Kirchoffer, W. G.
Kirschbraun, Lester.
Luten, Daniel B.
Potter, Alexander.
Van Trump, Isaac.
Wells, James P.

Contractors.
City Wastes Disposal Co.
Sullivan, Long & Hagerty.
Warren Bros. Co.

Contractors' Tools and Machinery.
Austin Machinery Corporation.
Austin-Western Road Machinery Co.
Good Roads Machinery Co., Inc.
Smith Co., T. L., The

Contractors' Wagons.
Austin Machinery Corporation.
Austin-Western Road Machinery Co.

Conveying Machinery.
Mead-Morrison Mfg. Co.
Pawling & Harnischfeger.
Portable Machinery Co., Inc.
Webster Mfg. Co.

Cranes and Hoists.
Austin Machinery Corporation.
Heltzel Steel Form & Iron Co.
Pawling & Harnischfeger.

Creosote.
The Barrett Co.
Republic Creosoting Co.

Creosoted Wood Block.
(Factory Floors, Bridge Floors)
Republic Creosoting Co.

Crushers, Rock and Ore.
Austin-Western Road Machinery Co.
Good Roads Machinery Co., Inc.

Culvert Pipe, Vitrified.
Canneiton Pipe Co.
Dee Clay Mfg. Co., Wm. E.

Culverts.
Austin-Western Road Machinery Co.
Newport Culvert Co.
Truscon Steel Co.

Curb and Gutter Forms.
Heltzel Steel Form & Iron Co.
Truscon Steel Co.

Curb Bar.
Truscon Steel Co.

in near future to grade, bridge and lay 18-ft. conc. pavement on State Hwy. No. 1, end of 7th St. Texarkana to point near Redwater. Est. cost $349,000. J. B. Pirky, Co. Judge; Owen D. Caldwell, County Engineer.

Tex., Crockett—Houston Co. plans 32 miles State Hwy. 19 betw. Palestine and Trinity, including brdgs. Est. cost $960,000. F. J. Von Zuben. Engr. L. L. Moore, Judge.

Tex., Decatur—Wise County plans highway impvts. votes Sept. 12th on $1,000,000 bonds.

Texas, Quanah—Hardeman County plans grading and constr. of bridges on about 32 miles State Hwy. No. 5. $600,000 available. Chas. Y. Welch, County Judge.

Tex., Texas City—City Commission plans to pave 6th St. $130,000 bonds voted.

Texas—Terry County (Brownfield) voted $200,000 rd. bonds. Plans 50 miles hard surf. highways. H. R. Winston, Co. Judge. Galveston County (Galveston) plans impvt. of Galveston-Houston rd. $500,000 bonds voted. E. B. Holman, Co. Judge.

Va., Covington—Alleghany Good Rds. Corp. (C. B. Nettleton,) plans bldg. Clifton Forge-Covington Hwy. Est. cost $150,000.

Va., Ft. Myer Heights—Arlington and Fairfax County Unit (Harry A. Fellows, Pres.) plans Lee Blvd., Virginia side of Memorial Bridge, circle Arlington cemetery to Bull Run battlefield, to New Shenandoah Pk. thru Falls Church to Fairfax.

W. Va., Beckley—Raleigh County, Beckley District, plans bldg. hard surf. roads; contemplates $660,000 bond election.

W. Va. Huntington—Cabell Co., Guyandotte Dist. plans 10 roads. $300,000 bonds voted. R. S. Douthal, Co. Clk.

SEWERAGE AND SEWAGE TREATMENT

Cal., Alhambra—Ord. adopted by City providing for issuance of $135,000 sewage disposal system bonds. City Clk. R. B. Wallace.

Cal., Los Angeles—Hearing is to be held soon by County Supvrs. on formation of County Sanitation Dist. 7, to include cities of So. Pasadena, Pasadena, San Marino, Alhambra, Monterey Park, San Gabriel, Sierra Madre, Monrovia, Arcadia, El Monte, Glendora, Azusa and Covina. Other districts included are Altadena, Temple, Baldwin Park, Rosemead and Wilmar. A. K. Warren, Girvin Bldg., 230 Court Bldg. Los Angeles, Engr.

Cal., No. Sacramento—(P. O. Sacramento) Plans being made for outfall sewer to connect with Sacramento, including pumping plant; 10,000 ft. cast iron pipe force main, etc. J. N. Bidwell, 1501 Del Paso Blvd. Engr.

Cal., Venice—City trustees have authorized Mayor Parkhurst to sign agreement with Santa Monica whereby latter will construct outfall sewer thru Santa Monica, the City of Venice to connect with and use in return for right-of-way granted.

Ont., Windsor—City plans san. sewer construction of various streets at cost of about $40,000. A. E. Brian, City Engr.

Fla., Pensacola—City considering voting on $160,000 sewer bonds, $100,000 bonds for golf course, $35,000 bonds for parks and playgrounds and $50,000 for water mains.

Fla., St. Augustine—City has plans by Peter Kendrick Engineering Co., for sewerage impvts. Will expend abt. $48,812.

Fla., St. Petersburg—Election Sept. 8th to vote on $365,000 bonds for sewage disp. plant. $43,000 for drainage and impvt. of Mirror Lake; $235,000 for purchase and installation of 2 units to power plant; $443,100 for storm sewers; $21,000 for constr. and enlargement of drainage ditches; $86,000 for impvts. to water plant; $964,000 for expanding water distribution system; $253,499 for exten. to gas plant; $236,501 for exten. of mains. Director of Public Utilities, R. E. Ludwig.

Fla., Sebring—$45,000 bonds voted here for sanitary sewers, $20,000 for storm sewers, $300,000 for light and water extensions, $75,000 for parks and piers.

Fla., Silver Bluff—City has plans for sewer system in central business district. $200,000 available.

Fla., West Palm Beach—First contracts for sewerage system in No. Borough will be let in Fall. Engrs. Fuller & McClintock, New York City, will design system.

Ky., Fulton—City will construct san sewerage system and disposal plant. Eight miles vitr. sewer pipe. Est. cost $70,000. Frank L. Wilcox, Cons. Engr. St. Louis, Mo.

Miss., Yazoo City—City will construct sewerage system on Grand Street, 8th to 15th Streets.

N. Y., Lackawanna—City plans to reconstruct sewage disposal plant at cost of about $350,000.

N. C., Asheville—City considering constr. of sewer line distance of 20 miles thru Swannanoa Valley. Est. cost $200,000. Chas. E. Waddell, Engr.

Ore., Grants Pass—Stevens & Koon, Portland, Cons. Engrs. retained by City in connection with contemplated sewer system. City Engr. estimated cost of impvt. at about $150,000. In planning the constr., which will include repair of old system and installation of several new units, the Cons. Engrs. will advise with E. C. Bell, City Engr. Grants Pass.

S. C., Spartanburg—City considering voted on $75,000 sewer bonds.

Tex., Abilene—City considering voting on $50,000 sewage disposal plant, $250,000 water purification plant. Chas. E. Coombes, Mayor.

Tex., Brownsville—$50,000 voted for sewerage system and disposal plant. Morgan L. Copeland, Secy.

Tex., San Angelo—City will construct sewerage system at est. cost of $275,000. Terrell Bartlett, Engrs., 612 Calcasieu Bldg., San Antonio.

Texas, Waco—City considering constr. of sewage disposal plant. $350,000 available. Mgr. E. E. McAdams.

Wash., Seattle—City considering question of issuing bonds in amt. of $1,653,000 to pay for constr. of sewers from shores of Lake Washington to the Sound. Funds to be voted on will finance 1st unit of sys. of pumping plants, intercepting sewers and trunk sewer intended to do away with emptying sewage into Lake Washington. Hanford Street sewer must be built immediately. Its cost is estimated at $1,556,000; 1st intercepting lake sewer and pumping plant will cost $97,000.

W. Va., Huntington—City Commission will make prelim. survey of sewerage impvts. $1,500,000 available.

WATER SUPPLY AND PURIFICATION

Ala., Birmingham—Birmingham Water Works Co., H. H. Horner, Supt., reported to expend $700,000 on improvements and expansions, including $40,000 for boiler at Cahaba station.

Cal., Alhambra—City has adopted Ord. providing for issuance of the $150,000 water system bonds. R. B. Wallace, City Clk.

Cal., San Diego—City Council has formally transferred $400,000 Otay pipe line funds to water main extension fund. Work is to start at once.

Cal., South Gate—$150,000 bonds voted here for acquisition and impvt. of South Gate Garden water works.

Cal., So. Pasadena—City trustees are contemplating issuing a call for election to vote on water bond issue. It is estimated that betw. $250,000 and $500,000 will be necessary.

Fla., Homestead—City will soon vote on $350,000 sewer and water extension bonds. $50,000 for parks and streets, $300,000 for electric lights.

Fla., Miami—City Commrs. authorized installation of abt. 200 new fire hydrants here at cost of $26,000; also extension of high pressure fire system at cost of $120,000.

Fla., Orange City—J. W. Camac, Daytona Beach, acquired 50-yr, franchise and plant of Orange City Mineral Springs, including 5 acres of land; will

BUYERS' GUIDE

Deep Well Pumps.
Harris Air Pump Co.
Keystone Driller Co.

Drag-Line Excavators.
Austin Machinery Corporation.

Drag Scrapers.
Austin-Western Road Machinery Co.

Drain Tile.
Dee Clay Mfg. Co., W. E.
Rosing, Inc., Astrid S.

Dryers.
Cummer & Son, The F. D.

Dump Cars.
Austin-Western Road Machinery Co.

Dump Wagons.
Austin-Western Road Machinery Co.

Dust Laying Compound.
The Barrett Co.
Standard Oil Co. (Indiana)
The Texas Co.

Dynamite.
E. I. du Pont de Nemours & Co., Inc.

Edge Protector.
Truscon Steel Co.

Electrical Machinery.
Westinghouse Electric & Mfg. Co.

Electrical Wires & Cables.
American Steel & Wire Co.

Elevating Graders.
Austin-Western Road Machinery Co.

Excavating Machinery.
Austin Machinery Corp.
Pawling & Harnischfeger.
Sauerman Bros.
Smith Co., T. L., The

Expansion Joint Compound.
The Barrett Co.
Carey Co., Philip, The
Pioneer Asphalt Co.
Truscon Steel Co.

Explosives.
E. I. du Pont de Nemours & Co., Inc.

Fillers (Paving Joint).
The Barrett Co.
Carey Co., Philip, The
Pioneer Asphalt Co.
The Texas Co.

Fire Brick.
Cannelton Sewer Pipe Co.
Dee Clay Mfg. Co., W. E.

Flue Liners.
Cannelton Sewer Pipe Co.
Dee Clay Mfg. Co., W. E.

Forms, Sidewalks, Curb & Gutter.
Heltzel Steel Form & Iron Co.
Truscon Steel Co.

Forms, Road.
Heltzel Steel Form & Iron Co.
Truscon Steel Co.

Gas Pipe.
U. S. Cast Iron Pipe & Fdy. Co.

Gates, Sluice.
Coldwell-Wilcox Co.

Graders.
Austin-Western Road Machinery Co.

Granite Block.
Granite Paving Block Mfrs. Assn. of the U. S., Inc.

Gunite.
Indiana Gunite & Const. Co.

Heaters (Rock and Sand).
Littleford Bros.

Heating Plants, Central.
American District Steam Co.

Heating Wagons (Oil and Tar).
Good Roads Machinery Co., Inc.
Littleford Bros.

Hoists (Concrete, Gasoline and Hand).
Pawling & Harnischfeger.

Hoists, Electric.
Mead-Morrison Mfg. Co.
Pawling & Harnischfeger.

Hoists, Steam.
C. H. & E. Mfg. Co.
Mead-Morrison Mfg. Co.

Hot Mixers.
Austin Machinery Corp.

Inlets (Sewer).
Dee Co., Wm. E.
Madison Foundry Co.

Insulating Material.
The Barrett Co.
Pioneer Asphalt Co.

Joint Fillers (Paving).
The Barrett Co.
Carey Co., Philip, The.
The Texas Company.

Kettles (Portable).
Cummer & Son Co., The F. D.
Good Roads Machinery Co., Inc.
Littleford Brothers.

Manhole Covers.
Madison Foundry Co.
Dee Co., Wm. E.

Mastic.
The Barrett Co.
Pioneer Asphalt Co.

Meter Boxes.
McNutt Meter Box Co.

Mixers, Asphalt.
Austin Machinery Corporation.
Cummer & Sons Co., The F. D.

Mixers, Concrete.
Austin Machinery Corp.
Koehring Co.
T. L. Smith Co.

Motor Fire Apparatus.
Duplex Truck Co.
Federal Motor Truck Co.
Garford Motor Truck Co.
International Motor Co.
Kissel Motor Car Co.
Pierce-Arrow Motor Car Co.

Motor Trucks.
Duplex Truck Co.
Federal Motor Truck Co.
Ford Motor Co.
International Motor Co.
Kissel Motor Car Co.
Pierce-Arrow Motor Car Co.

Motor Truck Flushers, Sprinklers, and Oilers.
Acme Motor Truck Co.
Austin Machinery Corporation.
Duplex Truck Co.
Federal Motor Truck Co.
Garford Motor Truck Co.
The Gramm-Bernstein Motor Truck Co.
International Motor Co.
Kissel Motor Car Co.
Pierce-Arrow Motor Car Co.

Municipal Castings.
Dee Co., Wm. E.
Madison Foundry.

Packing.
Pioneer Asphalt Co.

Paints (Asphalt).
Barrett Co., The
Pioneer Asphalt Co.

Paving Blocks (Creosoted).
The Barrett Co.
Republic Creosoting Co.

Paving Brick.
Murpysboro Paving Brick Co.
National Paving Brick Mfrs. Assn.

Paving Contractors.
Warren Bros. Co.

Paving Joint Compound.
The Barrett Co.
Carey Co., Philip, The
Pioneer Asphalt Co.
The Texas Company.

Paving Joint Filler.
The Barrett Co.
Carey Co., Philip, The.
Pioneer Asphalt Co.
The Texas Company.

Paving Machines.
Austin Machinery Corporation.
Cummer & Son Co., The F. D.
East Iron & Machine Co., The
Warren Bros. Co.

Paving Plants (Asphalt).
Austin Machinery Corporation.
Cummer & Son., The F. D.
East Iron & Machine Co., The
Good Roads Machinery Co., Inc.
Smith Co., T. L., The
Warren Bros. Co.

Pipe Cutters.
W. W. Strickler & Bros.

Pipe Dip and Coatings.
The Barrett Co.
Pioneer Asphalt Co.
The Texas Co.

Pipe Manufacturers.
U. S. Cast Iron Pipe & Fdy. Co.

Pitch Filler.
The Barrett Co.
Warren Bros. Co.

Plows (Rooter and Wing).
Austin-Western Road Mach. Co.

Portable Paving Plants.
Austin Machinery Corporation.
Cummer & Son Co., The F. D.
Good Roads Machinery Co., Inc.
Littleford Brothers.
Warren Bros. Co.

Portable Stone Bins.
Austin-Western Road Machinery Co.
Good Roads Machinery Co., Inc.

Powder (Blasting).
E. I. du Pont de Nemours & Co., Inc.

install elec. devices to increase pumping capy. and extend water mains.

Fla., St. Petersburg—City will vote Sept. 8th on $3,119,000 bonds for water reservoir at Mirror Lake. R. E. Ludwig, Director Public Utilities.

Ga., Atlanta—W. Zode Smith, Gen Mgr., Water Works System, recommended construction of feeder pipes throughout water works system. Est. cost $2,000,000.

Ill., Fairfield—City Council has approved plans for water works constr., which includes laying 10-in. water main from river, filtration plant of 700,000 gals, a day capy. and both gasoline and electrically-driven pumps. Plans will now be submitted to State Bd. of Health for approval.

Ill., Highland Park—City Commission has approved expenditure of $400,000 for trunk line water mains in section south of town which has been newly annexed.

La., Kenner—Prelim. plans being made for mains and distribution system; also san. sewers in various streets. Est. cost $80,000. H. A. Mentz, Citizens National Bank Bldg., Hammond, Engr.

Md., Baltimore—City (Howard W. Jackson, Mayor) will erect 9 brick structures on Hillen Road for water works. Est. cost $269,300.

Mass., Nahant—(Br. of Lynn) Board of Selectmen plans high pressure water system connected with Metropolitan water supply. $150,000. Engineer not selected.

Mo., Kansas City—Fire & Water Board approved recommendations of Fuller & Maitland, Engrs., 600 Walnut St. for changes and impvts. in plans for water plant settling basins now under constr. increasing capy. of coagulating basins, additional grading, increasing thickness of floors of coagulating basins and adding extra reinforcement to walls.

Mo., Lee's Summit—City voted $85,000 bonds for sewers and water works.

Mo., Portageville—$35,000 bonds voted here for completion of water works and distribution system. A. Moore, 222 W. 3rd St., Joplin, Engr.

Mo., Springfield—Springfield City Water Co., R. L. Pate, Mgr., will construct 1,000,000,000 gal. reservoir at Ritter Springs pumping sta.; is expending this year $200,000 for laying new pipe and other impvts.

Mont., Butte—Bids in soon for constr. of reservoir in Sun River canyon above Diversion dam. Gov. J. E. Erickson, Sec'y. Int. Hubert Work, Commr. of Reclamation, Elwood Mead. Bet. $3,000,000 and $4,000,000.

N. C., Asheville—Following completion of watershed, now under construction, it will be necessary to lay pipe line from City to Bee Tree watershed at est. cost of $400,000. F. L. Conder, Commr. of Public Works.

Ohio, Sandusky—Election in near future to vote on $200,000 bond issue for constr. of filtration plant; will also decide, at that time, on issue of $100,000 for drilling 20 deep wells.

Ore., Burns—Test well has been sunk as first step to be taken in constr. of water system and installation of sewer project which will cost about $280,000. Barr & Cunningham, Cons. Engs. Spalding Bldg., Portland. A. A. Durant, contractor of Walla Walla, Wash., is sinking the test wells. Bids may be called within six weeks for water system which will cost abt. $120,000; sewer system, $160,000. Storage of water and pressure will be obtained by large steel water tower. Mains and a distribution system will be installed.

Ore., Portland—Plans for $300,000 main thru districts that have been short of water will be worked out as soon as study can be made of effect that meters have had on consumption of water. Fred M. Randlett, Chief Engr. Main, or mains, may cost more than $300,000-$500,000. There is item in budget of Bureau for $300,000 for constr. of line from Mount Tabor reservoir to Vernon standpipe to supplement water supply there. It is probable that main will be at least 42 ins. and be a direct connect. betw. reservoir and standpipe and will not supply any other service.

Pa., South Pittsburgh—In order to prevent recurrence of water shortage in Squirrel Hill, American Water Works and Electric Co., will lay additional pipe line in South Pittsburgh from pumping stations on So. Pittsburgh Water Co. at expendt. of $250,000.

R. I., Woonsocket—Report presented by consulting engineers of Boston, Mass., states that Cranberry meadow watershed, which is beyond Mass., line, would supply proposed reservoir which Woonsocket may erect. Est. cost of reservoir, exclusive of land, $320,000. Pumping station may be erected at East Blackstone so that elec. power may be furnished by Blackstone Electric.

Tenn., Clinton—City has authorized issuance of $105,000 water works bonds; $60,000 for sewers; water supply to come from springs to be pumped to reservoir; elevation 200 ft. additional will be made to present distribution system. Approximately 6 miles san. sewers contemplated.

Tex., Ft. Worth—City will probably vote in Fall on $3,000,000 water bonds. O. E. Carr, City Mgr.

Tex., Lubbock—$150,000 water works bonds voted and also $150,000 sewer bonds.

Tex., Port Arthur—Plans being made for filtration plant handling 5 m.g. water daily. Cons. Engs. Burns & McDonnell Engrs. Co., 400 Interstate Bldg., Kansas City, Mo. Est. cost $200,000.

Va., Pulaski—$100,000 bonds voted for water improvements.

Va., Warrenton—City has voted $105,000 bonds for water, sewer and paving. For additional detailed information address the Mayor.

Wash., Tacoma—Extensive impvts. and enlargements to City's water sys, planned. Est. cost about $3,000,000. Work includes following: Replacement of Green River gravity line, constr. of 3 additional storage reservoirs in City; ultimate absorption of Tacoma Water Supply Co. and adequate service for nighest portions of City.

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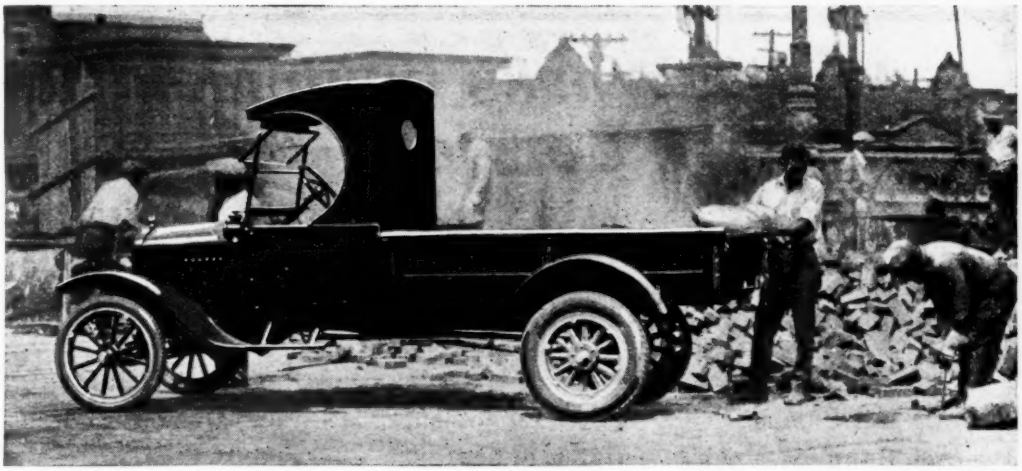

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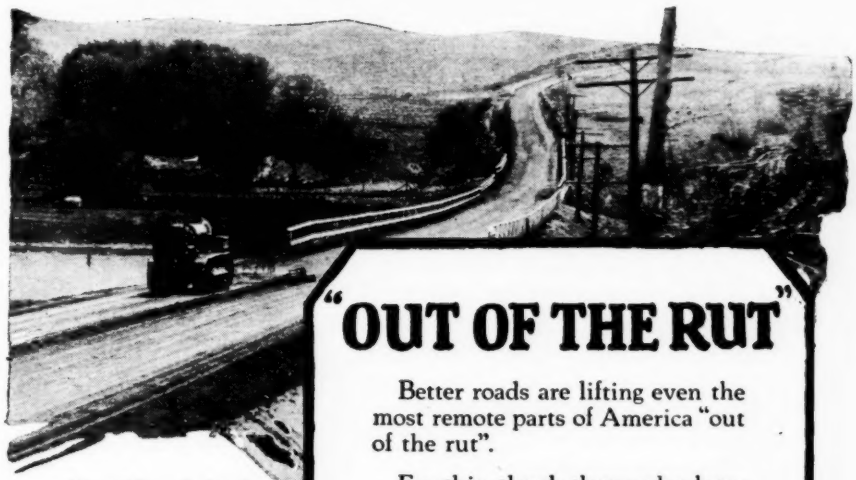

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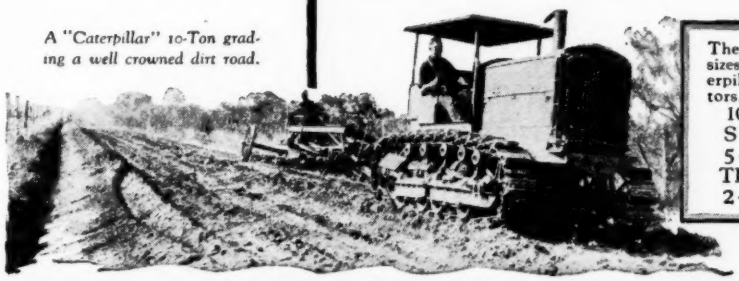

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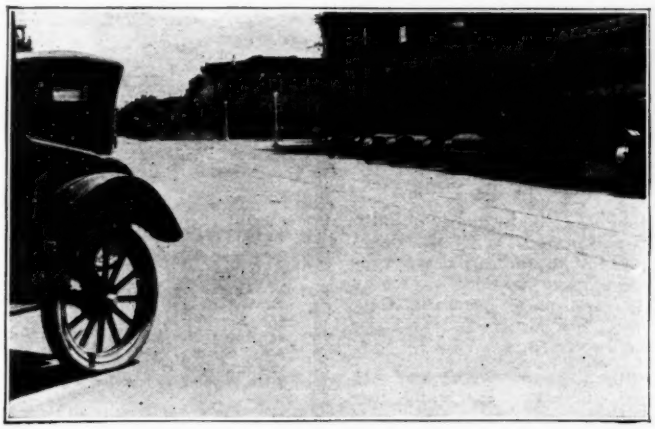

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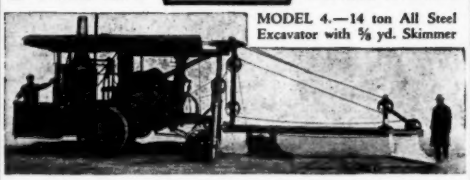

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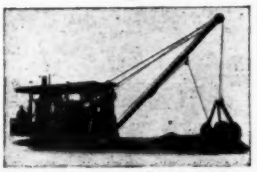

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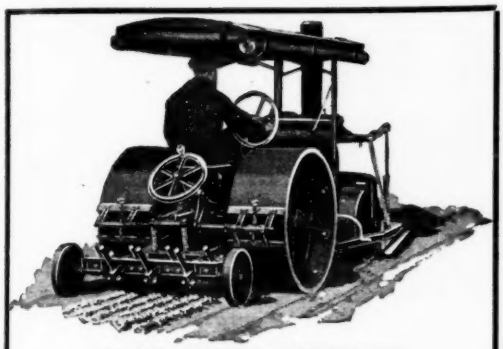

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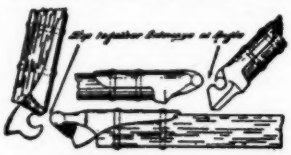

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AN ANSWER TO CRITICS OF FEDERAL APPROPRIATIONS FOR HIGHWAYS

By W. C. Markham, Executive Secretary, American Association of State Highway Officials, 638 Munsey Bldg., Washington, D. C.

[Editor's Note: This article originally bore the title, "Who Pays Uncle Sam's Bills?" It is an answer to those who claim that the States of greatest wealth are being unduly taxed to pay the cost of Federal appropriations for highways. This is new material on a very live subject. We are confident all our readers will find this article most interesting and very useful for reference purposes. It should settle many an argument this winter when Congress is in session and the debate starts. While the article is long, it is of such superlative importance that we are pleased to publish it in full.]

Who Pays Uncle Sam's Bills?

When the Federal Government wants funds to meet her obligations she calls upon her citizens, irrespective of residence, to pay according to their means.

States, as such, have no obligations, and tabulation of receipts for the Federal Treasury, by States, is misleading, unfair and in many cases far from the truth as to who meets the assessments.

A National Viewpoint Desirable

Probably the ideal way of considering the real business affairs of the Nation, as transacted by present-day methods, would be to discard all State lines and consider New York, Boston, Philadelphia, Baltimore, New Orleans, St. Louis, Chicago, San Francisco, etc., as clearing-house centers. But we have been in the habit of telling what this State does and what that State has accomplished, so long, that certain results are tabulated as by States, when in reality some States would actually starve if it were not for their neighbors. They have plenty of gold in the till, but no hills on which to graze cattle. Some of the richest States in the Union do not annually produce one-half of 1 per cent. of the basic wealth so necessary to our very national existence.

Some people can be born in one State, educated in another and attain business success in another—always at home, and proudly American. Others are like one of the early fathers, who, going 12 miles west of Boston, celebrated the event by erecting a stake on which he had inscribed: "Thus far shall civilization go and no farther."

Claim an Unequal Burden to States

In recent months a concerted effort has been made to try to prove that Federal co-operation with the States in certain endeavors is vicious, leads to extravagance and compels certain States to contribute to the Federal treasury beyond a just requirement. It is not the purpose of this article to discuss the merits or demerits of Federal financial co-operation with the States in certain endeavors. But it is our purpose to attempt to show that, while there are States given credit for very large payments into the Federal treasury, and the bookkeeping totals seem to give them grounds for such assumptions, in reality it is property often thousands of miles away from the bookkeeper's desk which furnishes the taxable wealth from which the seeming excess of contributions are made.

In entering the protest against Federal co-operation with the States in various enterprises tables have been widely published to prove that a few States really furnish more than 75 per cent. of the entire amounts collected by the Federal government for these purposes, and that they receive in return but a very small portion of what they pay into the treasury. At the same time other States are given sums far in advance of what they pay.

Since the larger part of these Federal contributions of late years has been for highways, these highway appropriations have been singled out as especially unfair.

Group Study by States

In reality no State pays more into the Federal treasury than is indicated by its wealth and population.

The total receipts of the Federal treasury, in a major part, come from internal revenue and customs duties. Those two items last year constituted 83.27 per cent. of the entire receipts. Since we have no way of prorating the tariff returns to the several States, this leaves us to consider internal revenue as the source from which the States pay funds direct to meet the bills of the Federal government. Last year internal revenue represented almost 70 per cent. of the total Federal receipts.

It is impossible to make a study of this situation except by certain comparative methods. To make tabulations showing the entire 48 States is unnecessary and to do so simply overburdens the line of investigation and makes it more difficult for one to follow the relationship of the

several States. We have therefore taken fifteen States from which to make certain deductions—the first fifteen States leading in various things around which center the basis for collecting funds for Federal appropriations. The items used for comparison are basic wealth, national wealth, population and internal revenue.

The first fifteen States in basic wealth are given because, while they may not pay into the Federal treasury as much as some States which are called "industrial," and are therefore capable of producing larger incomes, basic wealth is of vital importance to the entire nation and States providing such wealth need the fullest development. By basic products is meant the value of one year's production of wealth from minerals, forests, animals and agriculture (see full table of basic wealth on other page of this issue). Basic wealth gets the least return for its products. Many crops are perishable and must take the market price offered.

Naturally, we think that States having the greatest amount of total wealth should pay the largest sums to run the government, and population in relation to total wealth is an element for consideration.

FIRST FIFTEEN RANKING STATES IN PERCENTAGE OF TOTAL BASIC WEALTH OF THE NATION COMPARED TO THEIR PERCENTAGE OF THE NATION'S TOTAL WEALTH, THEIR PERCENTAGE OF TOTAL PAYMENTS THROUGH INTERNAL REVENUE AND POPULATION.

State	Percentage of Total Basic Wealth	Percentage of Total National Wealth	Percentage of Total Internal Revenue Paid	Percentage of Total Population
Pennsylvania	7.6	9.2	9.7	8.4
Texas	7.5	3.1	1.3	4.3
Illinois	5.2	7.1	7.7	6.0
California	4.8	4.8	4.6	3.6
Iowa	4.8	3.3	.06	2.2
Ohio	4.1	5.8	5.5	5.3
Oklahoma	3.6	1.2	.04	1.9
Missouri	3.5	3.1	2.4	3.2
Minnesota	3.2	2.7	1.1	2.2
New York	3.2	11.7	28.8	10.2
Kansas	3.0	2.0	.07	1.7
Indiana	3.0	2.8	1.6	2.7
Wisconsin	2.9	2.5	1.4	2.4
Michigan	2.7	3.6	7.9	3.3
West Virginia	2.5	1.4	.07	1.3
Total	61.6	64.3	72.24	58.7

There are 22 States in these 4 groups and it should be noted that the following States are always a part of the 4 groups given: California, Illinois, Indiana, Michigan, Missouri, New York, Ohio, Pennsylvania, Texas and Wisconsin.

FIRST FIFTEEN RANKING STATES IN PERCENTAGE OF TOTAL NATIONAL WEALTH IN COMPARISON WITH THEIR PERCENTAGE OF TOTAL PAYMENTS MADE BY THE STATES THROUGH INTERNAL REVENUES, POPULATION AND PERCENTAGE OF BASIC WEALTH.

State	Percentage of Total National Wealth	Percentage of Total Internal Revenues Paid	Percentage of Total Population	Percentage of Total Basic Wealth
New York	11.7	28.8	10.2	3.2
Pennsylvania	9.2	9.7	8.4	7.6
Illinois	7.1	7.7	6.0	5.2
Ohio	5.8	5.5	5.3	4.1
California	4.8	4.6	3.6	4.8
Massachusetts	4.1	5.0	3.5	.05
New Jersey	3.7	4.0	3.2	.07
Michigan	3.6	7.9	3.3	2.7
Iowa	3.3	.06	2.2	4.8
Missouri	3.1	2.4	3.2	3.5
Texas	3.1	1.3	4.3	7.5
Indiana	2.8	1.6	2.7	3.0
Minnesota	2.7	1.1	2.2	3.2
Wisconsin	2.5	1.4	2.4	2.9
Kansas	2.0	.07	1.7	3.0
Total	69.6	81.13	62.2	55.62

FIRST FIFTEEN RANKING STATES IN PERCENTAGE OF TOTAL NATIONAL POPULATION COMPARED TO THEIR PERCENTAGES OF THE TOTAL NATIONAL WEALTH, CREDITS IN PAYMENTS OF INTERNAL REVENUE AND TOTAL BASIC WEALTH.

State	Percentage of Total Population	Percentage of National Wealth	Percentage of Internal Revenue Paid	Percentage of Basic Wealth
New York	10.2	11.7	28.8	3.2
Pennsylvania	8.4	9.2	9.7	7.6
Illinois	6.0	7.1	7.7	5.2
Ohio	5.3	5.8	5.5	4.1
Texas	4.3	3.1	1.3	7.5
California	3.6	4.8	4.6	4.8
Massachusetts	3.5	4.1	3.0	.05
Michigan	3.3	3.6	7.9	2.7
New Jersey	3.2	3.7	4.0	.07
Missouri	3.2	3.1	2.4	3.5
Georgia	2.8	1.2	.06	1.6
Indiana	2.7	2.8	1.6	3.0
Wisconsin	2.4	2.5	1.4	2.9
North Carolina	2.3	1.4	5.7	2.4
Kentucky	2.2	1.1	1.0	2.4
Total	63.4	65.2	86.66	51.02

Two States are in all groups but one, Massachusetts and New Jersey, each not being in the basic wealth group.

Four States are in 2 groups, Iowa, Kansas and Minnesota in both basic and total wealth, and North Carolina in population and revenue paid.

Six States are in one group only—Connecticut and Virginia in revenue payments, Georgia and Kentucky in population, and Oklahoma and West Virginia in basic wealth.

FIRST FIFTEEN RANKING STATES CREDITED WITH LARGEST PAYMENTS OF INTERNAL REVENUE, 1924, COMPARED TO THEIR PERCENTAGE OF THE TOTAL NATIONAL WEALTH, POPULATION AND THE TOTAL BASIC WEALTH OF THE NATION.

State	Percentage Paid of Total Revenue	Percentage of Total National Wealth	Percentage of Total Population	Percentage of Total Basic Wealth
New York	28.8	11.7	10.2	3.2
Pennsylvania	9.7	9.2	8.4	7.6
Michigan	7.9	3.6	3.3	2.7
Illinois	7.7	7.1	6.0	5.2
North Carolina	5.7	1.4	2.3	2.4
Ohio	5.5	5.8	5.3	4.1
Massachusetts	5.0	4.1	3.5	.05
California	4.6	4.8	3.6	4.8
New Jersey	4.0	3.7	3.2	.07
Missouri	2.4	3.1	3.2	3.5
Virginia	1.6	1.5	2.1	.04
Indiana	1.6	2.8	2.7	3.0
Wisconsin	1.4	2.5	2.4	2.9
Connecticut	1.3	1.6	1.3	.03
Texas	1.3	3.1	4.3	7.5
Total	88.5	66.0	61.8	47.09

A More Intimate Inspection

Now let us study more closely these various elements as expressed in percentages of the total for the United States.

Notice first that in every column in each table, the total percentage shows that the 15 States considered furnish over 50 per cent of the entire percentages of the United States, with the exception of one—the group which pays 88.5 per cent of the total internal revenue furnishes 47.09 per cent of the total basic wealth. The general average of all the elements considered is 65.9 per cent of the percentage for the entire nation.

The 15 States leading in basic wealth have 61.6 per cent of the total national wealth. They pay 72.24 per cent of the internal revenue, have 64.3 per cent of the total national wealth and 58.7 per cent of the population.

The 15 States leading in total wealth have 69.6 per cent of the total national wealth, pay 81.13 per cent of the internal revenue, have 62.2 per cent of the population and furnish 55.62 per cent of the basic wealth.

The 15 States leading in population have 63.4 per cent of the total national population. They pay 86.66 per cent of the internal revenue, have 65.2 per cent of the total wealth and furnish 51.02 per cent of the basic wealth.

The 15 States leading in payments of internal revenue pay 88.5 per cent of the total national internal revenue. They have 66.0 per cent of the total wealth, 61.8 per cent of the population, and supply 48.09 per cent of the basic wealth.

In furnishing basic wealth, outside of the basic wealth group, the other groups are in the following order: Total wealth, 55.62 per cent; population, 51.02 per cent; payments in internal revenue, 47.09 per cent.

The groups of States having the largest amount of total wealth, outside of the total wealth group, are in the following order: Payments in revenue, 66.0 per cent; population, 65.2 per cent, and basic wealth, 64.3 per cent.

The groups of States having the largest population, outside of the population group, are in the following order: Total wealth, 62.2 per cent; payments in revenue, 61.8 per cent, and basic wealth, 58.7 per cent.

The groups of States making the largest payments in internal revenue, outside of the internal revenue group, are in the following order: Population, 86.66 per cent; total wealth, 81.13 per cent, and basic wealth, 72.24 per cent.

The groups ranked according to the highest percentages of the total for the United States are:

Payments in internal revenue..88.5 per ct.
Total wealth .....69.6 per ct.
Population .....63.4 per ct.
Basic wealth .....61.6 per ct.

You will notice that the total percentage for the group making payments of internal revenue is higher than any other group, although the population and total wealth groups are very close seconds in their payments of revenue, being 86.66 and 81.13, respectively.

Deductions Drawn

Closer observation of these groups by comparison shows that:

1. In total payments into the Federal treasury, the group having the largest population coincides very closely to the 15 highest in actual payments, being 86.66 per cent over against 88.5 per cent.

2. The group having the greatest total wealth follows closely with a percentage of revenue payments of 81.13 per cent.

3. This shows that the 15 States in population and the 15 States in total wealth follow very closely the 15 States in revenue payments.

4. In these comparisons one naturally supposes that population and total wealth would go hand in hand with revenue payments, and they do very closely as far as total percentages are concerned, but the

list of States changes and consideration of population and total wealth brings 6 other States into the reckoning.

5. If the Federal government used the method of raising funds by a general levy on all property these groups of States would not shift so much.

6. Connecticut and Virginia, representing .07 per cent of the entire basic wealth of the nation, when we come to make up the population group, give way to Georgia and Kentucky, which furnish 4.0 per cent of all the basic wealth. Also, Connecticut, North Carolina and Virginia, representing 2.47 per cent of the entire basic wealth of the nation, when we come to make up the total wealth group, give way to Iowa, Kansas and Minnesota, which furnish 11 per cent of all the basic wealth.

If this last group of States were manufacturing tobacco products instead of corn and wheat products they would also be in the first 15 States paying internal revenue.

Who Really Pays the Bills?

This brings us to a concrete study of the group making the largest payments into the Federal treasury. It will be noticed that the following States pay a much larger percentage than their percentage of total wealth or population—New York, Michigan and North Carolina:

State	Payments	Total Wealth	Population
New York	28.8	11.7	10.2
Michigan	7.9	3.6	3.3
North Carolina	5.7	1.4	2.3

The question arises as to the cause for this excess of payments.

In the case of Michigan it is immediately and satisfactorily explained when it is understood that 43 per cent of the total tax paid by Michigan is excise on automobiles and 73 per cent of all the automobile excise tax of the United States is collected in Michigan. When it is known that there is an average of $31 per car collected it can be understood how this large fund is really spread out over the country, for the purchaser of the car pays the bill.

Here is a list of the cars, by States, which paid this excise tax last year:

Alabama	31,213	Nebraska	31,874
Arizona	9,744	Nevada	1,091
Arkansas	44,327	New Hamp.	11,236
California	158,275	New Jersey	84,922
Colorado	24,034	New Mexico	6,385
Connecticut	46,243	New York	221,091
Delaware	6,586	N. Carolina	30,651
Florida	36,584	N. Dakota	13,285
Georgia	27,453	Ohio	141,454
Idaho	10,269	Oklahoma	73,045
Illinois	166,543	Oregon	27,596
Indiana	85,397	P'nnsylvania	200,027
Iowa	76,936	Rhode Island	16,717
Kansas	55,411	S. Carolina	33,806
Kentucky	38,743	S. Dakota	14,794
Louisiana	24,495	Tennessee	44,710
Maine	19,273	Texas	178,531
Maryland	44,473	Utah	11,495
Mass'chusetts	94,622	Vermont	10,955
Michigan	161,561	Virginia	48,325
Minnesota	63,772	Washington	35,193
Mississippi	42,271	West Va.	30,929
Missouri	98,099	Wisconsin	84,860
Montana	9,414	Wyoming	6,699

Of the Michigan income tax the Fords alone paid $18,901,000. It should be stated, however, that the people of Michigan have not made any claim that they are paying more than their due share of the internal revenue.

As to North Carolina, a similar explanation can be made. North Carolina's seeming excess is even more startling, for 86 per cent of the total internal revenue paid by North Carolina is on tobacco in its manufactured form, and the purchaser, wherever he may live, pays for the revenue stamp. North Carolina likewise is not making any complaint.

Before we take up the case of New York, it should be noted, in passing, that all of the other States in this group are not paying much more, if as much as their total wealth and population would seem to demand.

State	Revenue	Wealth	Population
Pennsylvania	9.7	9.2	8.4
Illinois	7.7	7.1	6.0
Ohio	5.5	5.8	5.3
Massachusetts	5.0	4.1	3.5
California	4.6	4.8	3.6
New Jersey	4.0	3.7	3.2
Missouri	2.4	3.1	3.2
Virginia	1.6	1.5	2.1
Indiana	1.6	2.8	2.7
Wisconsin	1.4	2.5	2.4
Connecticut	1.3	1.6	1.3
Texas	1.3	3.1	4.3

While Massachusetts and New Jersey show a slight increase of payments in excess of wealth, the results obtained from a study of New York State are the same for these States except in a much less degree. Massachusetts, New Jersey, Virginia and Connecticut together barely furnish an average of one-half of 1 per cent of the basic wealth of the Nation from each State. Virginia would not be in this group at all if it were not for the tobacco revenue tax, which is 56 per cent of the total internal revenue paid through that State. And Virginia, likewise, is not complaining.

Is New York Imposed Upon?

By public address and newspaper articles, broadcast throughout the country, statements have repeatedly been made that New York pays over 25 per cent of every bill that Uncle Sam must meet.

Let us see. The keeper of accounts credits New York with having paid 28.8 per cent of the total internal revenue collected. Normally, wealth and population

ESTIMATED VALUE OF BASIC PRODUCTS AND TOTAL WEALTH

State	Mineral (A)	Rank	Forest (B)	Rank	Animal (C)	Rank	Agriculture (C)	Rank	Total Value Basic Products	Rank	Estimated Total Wealth Census 1922	Rank
Alabama	$82,496,000	16	$52,792,000	8	$58,000,000	29	$239,000,000	19	$433,188,000	21	$3,002,043,000	30
Arizona	105,066,000	13	4,186,000	33	16,900,000	44	38,200,000	42	164,352,000	35	1,314,291,000	43
Arkansas	41,954,000	26	73,468,000	6	68,700,000	25	218,300,000	22	402,422,000	22	2,599,617,000	32
California	381,012,000	4	86,959,000	5	169,500,000	14	470,709,000	4	1,108,171,000	4	15,031,734,000	5
Colorado	61,222,000	21	1,209,000	39	96,600,000	20	138,900,000	29	297,931,000	30	3,229,412,000	29
Connecticut	7,177,000	40	1,589,000	36	27,000,000	41	52,500,000	39	88,266,000	44	5,286,445,000	17
Delaware	416,000	48	683,000	42	8,000,000	47	18,000,000	46	27,099,000	47	625,765,000	47
Florida	12,558,000	36	45,150,000	11	15,400,000	45	73,300,000	34	146,408,000	38	2,440,491,000	34
Georgia	14,300,000	34	30,037,000	15	76,400,000	22	248,400,000	18	367,377,000	25	3,896,759,000	25
Idaho	27,105,000	28	39,479,000	12	52,200,000	31	85,500,000	32	204,284,000	33	1,533,941,000	41
Illinois	288,100,000	5	5,096,000	30	412,900,000	2	482,809,000	3	1,188,896,000	3	22,232,794,000	3
Indiana	132,180,000	10	14,712,000	23	267,600,000	9	274,800,000	15	689,292,000	12	8,829,726,000	12
Iowa	46,175,000	24	958,000	40	545,000,000	1	500,100,000	2	1,092,233,000	5	10,511,682,000	9
Kansas	109,392,000	12	871,000	41	287,400,000	7	299,500,000	11	697,163,000	11	6,264,058,000	15
Kentucky	148,854,000	9	15,375,000	22	146,100,000	17	237,600,000	20	547,929,000	18	3,582,391,000	26
Louisiana	61,199,000	22	132,682,000	3	25,300,000	42	169,400,000	26	388,581,000	23	3,416,860,000	28
Maine	7,566,000	38	20,162,000	20	41,000,000	35	57,300,000	38	126,028,000	40	2,006,531,000	38
Maryland	27,190,000	31	3,538,000	35	42,000,000	34	71,000,000	55	137,728,000	39	3,990,730,000	24
Massachusetts	14,774,000	33	4,946,000	31	44,200,000	33	58,700,000	37	122,620,000	41	12,980,839,000	6
Michigan	128,316,000	11	50,097,000	10	184,800,000	13	254,800,000	17	618,013,000	14	11,404,861,000	8
Minnesota	174,105,000	8	28,191,000	18	214,800,000	12	317,900,000	9	734,996,000	9	8,547,918,000	13
Mississippi	2,163,000	46	92,033,000	4	56,300,000	30	203,600,000	23	354,096,000	26	2,177,690,000	37
Missouri	79,199,000	17	13,246,000	26	372,500,000	3	337,400,000	7	802,345,000	8	9,981,409,000	10
Montana	74,707,000	19	13,197,000	27	70,100,000	24	108,500,000	30	266,504,000	31	2,223,189,000	36
Nebraska	3,302,000	45	.....	47	260,500,000	10	300,400,000	10	564,202,000	16	5,320,075,000	16
Nevada	28,593,000	27	557,000	44	12,200,000	46	9,800,000	47	51,150,000	46	541,716,000	48
New Hampshire	3,573,000	42	13,300,000	25	22,000,000	43	21,000,000	45	59,873,000	45	1,374,135,000	42
New Jersey	72,454,000	20	639,000	43	39,800,000	36	59,300,000	36	172,193,000	34	11,794,189,000	7
New Mexico	23,791,000	29	4,090,000	34	33,800,000	39	27,400,000	44	89,081,000	43	851,836,000	45
New York	89,865,000	14	15,406,000	21	293,400,000	6	332,000,000	8	730,671,000	10	37,035,262,000	1
North Carolina	10,006,000	37	38,051,000	13	76,600,000	21	436,800,000	5	561,457,000	17	4,543,110,000	21
North Dakota	3,473,000	44	.....	48	65,100,000	27	161,400,000	27	229,973,000	32	2,467,772,000	33
Ohio	287,884,000	6	8,967,000	28	311,600,000	5	342,500,000	6	950,951,000	6	18,489,552,000	4
Oklahoma	398,858,000	3	4,637,000	32	152,000,000	15	278,500,000	13	833,995,000	7	3,993,524,000	23
Oregon	6,054,000	41	140,538,000	2	70,600,000	23	99,300,000	31	316,492,000	28	3,419,459,000	27
Pennsylvania	1,227,030,000	1	13,681,000	24	244,000,000	11	271,300,000	16	1,756,011,000	1	28,833,745,000	2
Rhode Island	1,023,000	47	121,000	45	6,000,000	48	4,700,000	48	12,444,000	48	1,924,326,000	39
South Carolina	3,550,000	43	29,257,000	16	38,000,000	37	275,100,000	14	345,907,000	27	2,404,845,000	35
South Dakota	7,372,000	39	1,383,000	37	98,400,000	19	202,300,000	24	309,455,000	29	2,925,968,000	31
Tennessee	14,186,000	25	35,066,000	14	150,300,000	16	218,500,000	21	448,052,000	20	4,228,251,000	22
Texas	264,232,000	7	51,879,000	9	281,700,000	8	1,119,000,000	1	1,716,811,000	2	9,850,888,000	11
Utah	86,458,000	15	58,000	46	29,000,000	40	39,700,000	41	154,216,000	36	1,535,477,000	40
Vermont	13,910,000	35	6,639,000	29	44,400,000	32	44,600,000	40	109,549,000	42	842,040,000	46
Virginia	48,052,000	23	25,427,000	19	106,300,000	18	195,600,000	25	375,379,000	24	4,891,570,000	19
Washington	22,169,000	30	290,667,000	1	67,300,000	26	157,500,000	28	537,636,000	19	5,122,405,000	18
West Virginia	413,075,000	2	28,727,000	17	60,300,000	28	80,400,000	33	582,502,000	15	4,677,919,000	20
Wisconsin	19,131,000	32	53,486,000	7	312,900,000	4	288,600,000	12	674,117,000	13	7,866,081,000	14
Wyoming	77,665,000	18	1,230,000	38	37,300,000	38	32,200,000	43	148,395,000	37	976,239,000	44
Total	$5,176,932,000	.....	$1,494,462,000	.....	$6,111,900,000	.....	$9,653,100,000	.....	$22,736,394,000	.....	$313,021,560,000	.....

A—U. S. Geological Survey. B—Bureau of Census. C—Dept. of Agriculuture.

considered, New York should pay 10.9 per cent. If all the facts could be secured it could easily be shown that that is really all she is doing now. Publicity of income taxes paid and much painstaking study of tabulations, some of which seem to be made more for bewilderment than elucidation, enable one to at least scratch the surface and present to the public a fair and well-substantiated statement as to the real situation.

The total internal revenue credited to New York, in round numbers, is $690,400,000. Of this amount $506,593,000, or over 73 per cent, comes from corporation and individual incomes. And 40.9 per cent of the 73 per cent is from corporations. Speaking of personal income tax paid in New York, who is it that does not understand that the $7,500,000 personal income tax paid last year by Mr. Rockefeller represented earnings collected from many States? Always remember that corporations pay an income tax only when a profit exists. Such is not the case in personal obligations above certain exemptions. With corporations it is: "No Profits, No Income Tax." In 1922 (last Federal report) the corporations in New York paid 25.59 per cent of all the corporation tax of the United States and still were able to declare cash dividends to their stockholders of over $975,724,000, and also stock dividends of over $1,229,572,000. No one begrudges their prosperity. The total number of corporations in the United States paying an income tax that year was 212,535. Of this number, 35,504 paid an income tax in New York—almost three times as many as Pennsylvania, and yet New York has only 11.7 per cent of the total national wealth, while Pennsylvania has 9.2 per cent of the total national wealth.

Again, according to the latest Federal report (1922) the total corporation tax paid in the United States that year was $783,776,268, which was 47.6 per cent of the entire income tax. Manufacturing paid $389,776,280, or 40.9 per cent of all corporation tax, or 23.7 per cent of all income tax of the nation.

New York paid 22.8 per cent of all corporation tax paid by "manufacturing," while Pennsylvania paid but 11 per cent. The same year manufacturing plants and equipment were valued in New York State at $2,133,897,000, while the same kind of property was valued by the Federal report at $2,193,873,000 for Pennsylvania. Since New York paid more than twice as much as Pennsylvania on a less valuation, there is no other conclusion to be drawn but that there are manufacturing corporations paying income tax in New York which have no property whatsoever in that State.

In 1921 (last Federal report) manufacturing plants in New York State showed a production of $6,973,506,000 and those in Pennsylvania a total output of $5,059,009,000. At the same time the corporations under the head of manufacturing in New York paid a Federal tax of $89,131,469, while those of Pennsylvania paid $42,992,173. This shows that the industries in Pennsylvania produced 72 per cent as much as New York, while the Federal tax paid was but 48 per cent as large as that of New York. No one would accuse Uncle Sam of letting Pennsylvania pay a less proportionate share than New York, hence the only conclusions to be drawn are again to assert that manufacturing corporations pay taxes in New York which have their property in other States.

Then, again, railroads and equipment in New York State have a value of $1,479,682,000, and street railways, shipping, water works, etc., are valued at $2,594,070,000, making a total for transportation and other utilities of $4,073,752,000. Pennsylvania for the same items has a value on railroads and equipment of $1,902,737,000 (exceeding that of New York) and $1,268,165,000 on street railways, shipping, etc., making a total of $3,170,902,000. These properties in New York paid an income tax of $40,459,465, while Pennsylvania paid but $9,920,949. At the valuation rate Pennsylvania should have paid around $30,000,000. Some one might suggest that many Pennsylvania corporations failed to show a net income, hence their income tax was below normal. The facts are, however, that a larger percentage of corporations in New York failed to show a net income than in Pennsylvania. There is, therefore, but one answer to this situation, i. e., that there are transportation corporations paying an income tax in New York which have no property there. (See illustration Southern Pacific and Union Pacific Railroads.)

On page 30 of "Statistics of Income" of the Treasury Department (1922) in connection with table showing the net income and taxes paid on personal and corporation income, by States, the Treasury Department gives this word of explanation:

ORDINARY FEDERAL EXPENDITURES WITHIN THE STATES DURING THE FISCAL YEAR ENDING JUNE 30, 1924

State	Rural Post Roads and National Forest Roads	Pensions (A)	Post Office Department (B)	Public Buildings, Rivers and Harbors (C)	National Parks, Land Office Reclamation Service Indian Affairs (D)	War and Navy (E)	Miscellaneous (F)	Total (G)	Percentage of Total
Alabama	$2,186,659	$879,621	$3,709,398	$12,631,260	$36,424	$4,159	$998,085	$20,445,606	2.593
Arizona	1,389,324	350,226	403,995	89,989	1,065,527	.....	1,555,166	4,854,227	0.615
Arkansas	1,172,493	2,382,144	2,706,530	338,254	99,737	.....	608,432	7,307,590	0.926
California	4,150,807	12,253,369	7,991,858	2,665,878	1,492,813	17,821,967	3,203,181	49,579,873	6.289
Colorado	1,521,412	2,356,452	2,276,181	42,060	766,000	12,670	1,056,613	8,031,388	1.019
Connecticut	68,158	2,349,714	2,469,670	317,854	.....	787,178	1,125,463	7,118,037	0.903
Delaware	431,030	506,454	482,497	1,495,532	.....	6,249	112,757	3,034,519	0.385
Florida	$24,003	1,767,504	1,900,591	1,754,247	14,373	4,040,556	453,023	10,754,297	1.364
Georgia	2,296,133	810,588	5,164,261	1,423,857	.....	96,239	881,476	10,672,554	1.354
Idaho	2,370,667	711,888	949,322	.....	3,927,925	.....	334,842	8,294,644	1.052
Illinois	5,006,497	15,196,396	16,137,086	1,079,079	.....	3,658,724	3,439,171	44,516,953	5.647
Indiana	2,665,250	13,404,831	7,209,955	1,540,644	.....	.....	560,065	25,380,745	3.219
Iowa	2,504,375	7,693,140	7,417,081	67,429	.....	.....	650,359	18,332,384	2.325
Kansas	2,610,683	8,624,400	6,044,542	47,007	217,322	114,188	317,821	17,975,963	2.280
Kentucky	2,018,400	5,776,857	3,859,530	2,214,377	.....	26,779	1,319,201	15,215,144	1.930
Louisiana	1,293,072	1,286,892	2,057,266	3,878,457	8,326	291,867	918,787	9,734,667	1.235
Maine	741,779	3,253,424	2,138,629	33,264	28,471	39,094	237,356	6,472,017	0.821
Maryland	603,527	2,408,022	2,748,630	1,772,677	.....	9,145,434	1,118,645	17,796,935	2.257
Massachusetts	926,286	7,955,001	8,031,992	496,583	.....	15,403,279	1,705,440	34,518,581	4.378
Michigan	2,319,263	9,179,322	8,672,466	2,323,979	92,879	560	708,662	23,297,131	2.955
Minnesota	1,894,253	3,540,000	6,885,498	98,528	72,959	868	1,566,334	14,058,440	1.783
Mississippi	1,524,648	1,096,924	2,914,928	216,440	45,389	34,037	506,947	6,339,313	0.804
Missouri	3,742,825	11,578,407	9,081,822	1,323,414	.....	.....	1,384,741	27,111,209	3.439
Montana	1,814,723	752,408	1,171,913	.....	1,651,561	.....	525,880	5,916,485	0.750
Nebraska	1,026,175	3,415,923	4,086,945	.....	92,492	.....	279,952	8,901,487	1.129
Nevada	1,942,430	98,898	161,985	2,473	547,277	.....	82,144	2,835,207	0.360
New Hampshire	339,300	1,430,880	1,222,472	799	.....	5,858,473	144,162	8,996,086	1.141
New Jersey	607,306	4,539,576	5,176,288	1,598,695	.....	2,050,853	761,568	14,734,286	1.869
New Mexico	674,524	422,256	512,752	3,574	622,598	.....	1,207,885	3,443,589	0.437
New York	3,928,048	16,548,132	23,079,281	5,277,087	10,582	20,090,451	4,106,617	73,040,198	9.265
North Carolina	1,567,356	1,042,896	4,247,123	755,230	.....	34,526	1,800,787	9,447,918	1.198
North Dakota	1,352,850	412,212	2,272,485	31,953	330,581	.....	155,680	4,555,761	0.578
Ohio	3,713,432	20,445,719	12,633,350	2,610,618	.....	120,951	1,218,858	40,772,928	5.172
Oklahoma	2,295,063	3,377,178	4,211,500	124,597	658,366	13,728	632,697	11,313,129	1.435
Oregon	2,802,823	2,519,028	1,873,528	973,872	1,231,011	220,740	484,211	10,105,213	1.282
Pennsylvania	1,045,722	18,198,069	15,750,021	3,651,311	.....	14,323,155	2,309,157	55,277,435	7.012
Rhode Island	266,421	1,098,312	931,107	224,068	.....	9,259,340	173,138	11,952,386	1.516
South Carolina	1,181,758	475,479	2,581,160	258,379	.....	1,762,591	545,763	6,805,130	0.863
South Dakota	2,019,651	1,097,229	2,173,509	375	865,185	225,603	178,200	6,559,752	0.832
Tennessee	1,780,741	3,849,290	4,883,941	26,468	.....	.....	614,771	11,155,211	1.415
Texas	5,510,167	2,400,750	8,131,712	3,894,064	.....	909,542	1,413,607	22,259,842	2.824
Utah	1,392,586	411,888	758,970	26,891	184,594	.....	149,551	2,924,480	0.371
Vermont	314,895	1,499,463	1,188,749	.....	.....	45,000	125,824	3,173,931	0.403
Virginia	2,475,844	1,856,238	4,638,382	582,501	.....	19,200,655	454,335	29,207,955	3.705
Washington	1,534,567	3,214,083	2,892,221	479,087	1,882,572	11,004,586	1,259,619	22,206,735	2.817
West Virginia	678,602	2,682,000	2,473,949	330,353	.....	263,906	286,722	6,715,532	0.852
Wisconsin	1,794,313	5,201,020	6,634,645	1,124,308	157,600	2,080	882,479	15,796,445	2.004
Wyoming	1,735,650	276,060	412,744	515	6,526,543	.....	482,984	9,434,496	1.197
Totals	$88,068,491	$212,626,563	$225,354,460	$57,828,027	$22,569,107	$136,870,028	$45,039,158	$788,373,834	100.000

General Note: Expenditures are divided into ordinary and public debt expenditures. For this table Post Office Department expenditures have been included with ordinary expenditures.

(A) From report of the Commissioner of Pensions. (B) From Annual Report of the Postmaster General. (C) From the Treasury Department, combined statement of the receipts and disbursements, balances, etc., of the United States for Public Buildings and from the Report of the Chief of Engineers, U. S. Army for Rivers and Harbors. (D) Combined data taken from the Treasury Department combined statement, Report of the Commissioner of the General Land Office, and the Annual Report of the Reclamation Service. (E) From the Treasury Department combined statement and the Report of the Paymaster General of the Navy. (F) Combined from data contained in the Report of the Commissioner of Internal Revenue, Report of the Federal Board for Vocational Education, Report of the Veterans Bureau, Report of the Forester, and the combined statement of the Treasury Department for the Bureau of Lighthouses, Bureau of Fisheries, and Mints and Assay Offices. (G) This amount is 19.3% of the total ordinary expenditures for the fiscal year 1924. (H) Expenditures in Alaska, District of Columbia, and the Insular Possessions, and those that were not definitely allocated to states in published reports have not been included in the table. (I) Total Expenditures $4,094,054,631 which includes $940,513,462 paid as interest and premium on the Public Debt and $587,376,916 spent by the Post Office Department. (J) Ordinary expenditures $2,566,164,253; Public Debt and Interest $940,513,462; Post Office Department $587,376,916.

"The amounts do not represent, however, what may be called the geographical distribution of income. The figures are compiled from the returns filed in each State. An individual files his income tax return in the collection district in which his legal residence or principal place of business is located, and a corporation files its income tax return in the collection district in which its principal place of business or the principal office or agency is located. Consequently, income reported by an individual or corporation in one State may have been derived from sources in other States. From the foregoing it will be clear that there is no way of ascertaining from the income tax returns the amount of income earned in the respective States or the amount of tax paid on that basis."

Who Owns the New York Corporations and Where Is Their Property?

It is naturally an impossible task to find the ownership of the corporations listed to pay income tax in New York, for while there were, according to the last Federal report, 35,504 corporations which paid an income tax, there were also 29,358 which, through making certain deductions, were relieved from paying an income tax. Therefore, to list this number of corporations—64,862—as to who controls them, where their property really exists and who enables them to make a profit so they can pay an income tax, shall not be attempted.

Surely a reasonable number of illustrations will serve to prove the statement that residents of New York are not the sole owners of many of the corporations paying an income tax in that State, and in many cases little or none of the property creating the profits is in that State.

United States Steel Corporation

The United States Steel Corporation, in 1923, paid an income tax of $16,000,000 in New York. They have 145 plants and warehouses, only two of which are located in New York State. They have 153,350 stockholders who really paid this income tax. These stockholders hold residence as follows:

Alabama	1,678	New Mexico	35
Arizona	52	New York	32,322
Arkansas	38	N. Carolina	348
California	2,004	N. Dakota	22
Colorado	424	Ohio	9,574
Connecticut	5,800	Oklahoma	84
Delaware	507	Oregon	173
Dist. of Col.	1,313	Pennsylvania	41,917
Florida	364	Rhode Island	1,385
Georgia	344	S. Carolina	103
Idaho	27	S. Dakota	37
Illinois	10,048	Tennessee	457
Indiana	2,406	Texas	215
Iowa	341	Utah	76
Kansas	137	Vermont	986
Kentucky	1,205	Virginia	780
Louisiana	325	Washington	239
Maine	1,234	W. Virginia	2,057
Maryland	1,493	Wisconsin	1,112
Mass'chusetts	11,100	Wyoming	20
Michigan	3,279	Alaska	8
Minnesota	4,412	Canal Zone	18
Mississippi	122	Hawaii	21
Missouri	1,347	Philippine I.	9
Montana	83	Porto Rico	25
Nebraska	168	Foreign	2,716
Nevada	20		
New Hamp.	1,835	Total	153,350
New Jersey	6,495		

Attention is called to the fact that there are more stockholders of this company living in Pennsylvania than in New York.

Railroads

Probably the most flagrant examples of the railroad situation are the Union Pacific and Southern Pacific. The Union Pacific in 1923 paid an income tax in New York of $4,500,000, and yet this road does not operate east of Omaha and Kansas City—half the length of the continent from New York State.

The Southern Pacific paid a tax of $5,000,000 and this road does not run any nearer New York than New Orleans.

No attempt will be made to give the list of stockholders of these two railroads, but it is common knowledge that they live in many States.

The Banks

It is well known that New York is our financial center, and we must have financial centers.

On May 15, 1925, the statement of the United States Treasury Department showed that while the deposits in the New York City National banks totaled $2,218,027,000, a study of this statement shows that 38 per cent of those deposits were from banks and trust companies outside of New York State.

Just a Few More Examples

There are over 64,800 corporations making reports to the Federal government through New York State. Here are 24 examples, in addition to the ones above mentioned—hardly a drop in the bucket—with whose names you are more or less familiar. The mention of them immediately makes you realize how they permeate so many activities of the business life of the nation. They do not know State lines. Transportation has enabled them to carry their products to the remotest hamlet. Only 24—and yet their paid-up capital stock is $2,380,242,000, and their net income last year, after paying their income tax, was $376,955,787, or 15.8 per cent. This statement of capital

SOURCES OF INTERNAL REVENUE—FISCAL YEAR 1924

Taken from the Annual Report of the Commissioner of Internal Revenue

States	Income (Individuals, Partnerships* and Corporations)	Estates (Transfer of Net Estates of Decedents)	Distilled Spirits and Alcoholic Beverages	Tobacco and Tobacco Manufacture	Stamp Taxes (Documentary and Playing Cards)	Telegraph and Telephone	Excise Tax (Automobiles, Cameras, Candy, Jewelry, Etc.)	Special Taxes (Brokers, Theaters, and Misc.)	Admission Theaters, Club Dues, Etc.	Miscellaneous (Oleomargarine Non-alcholic Beverages, Narcotics, Etc.)	Total All Sources
Alabama	$7,984,248.70	$264,656.37	$3,942.26	$19,590.25	$273,481.55	$23,609.34	$219,874.02	$483,478.96	$444,105.91	$83,983.57	$9,800,970.93
Arizona	1,591,667.27	60,222.03	.....	842.74	69,092.69	4,364.99	54,300.08	182,630.48	155,055.29	13,063.28	2,131,228.85
Arkansas	5,431,632.83	92,544.55	.....	7,788.57	211,470.96	52,044.52	135,638.54	240,245.18	300,898.08	64,372.64	6,536,635.87
California	92,401,441.98	4,428,672.88	2,490,874.83	5,904,127.93	3,053,600.92	1,927,214.67	4,420,050.98	4,718,381.51	6,708,801.87	2,973,286.28	129,026,453.85
Colorado	11,543,616.03	359,936.66	61,085.26	134,173.47	325,073.54	475,809.45	509,780.06	1,041,062.87	676,376.23	101,123.68	15,228,037.25
Connecticut	26,901,779.90	2,706,996.15	11,929.31	301,709.79	445,023.85	431,472.84	3,362,291.29	1,318,076.59	1,386,886.79	140,366.01	37,006,532.52
Delaware	9,127,303.62	71,499.98	125.00	662,399.50	122,949.96	5,579.75	47,444.75	629,760.19	110,419.55	27,619.38	10,805,101.68
Florida	8,005,449.14	1,118,980.51	625.00	4,590,628.57	628,891.33	63,532.77	199,179.15	474,631.52	606,774.17	131,135.82	15,819,827.98
Georgia	13,869,531.55	480,572.26	600.00	119,051.27	430,634.12	1,154,742.78	419,342.07	751,264.59	630,041.06	1,325,666.52	19,181,446.22
Idaho	1,271,318.63	126,335.86	.....	7,080.49	80,946.33	8,840.88	54,568.79	200,355.99	210,882.68	15,754.63	1,976,084.28
Illinois	16,072,008.68	6,497,455.15	5,833,670.00	6,996,671.12	5,331,365.40	1,401,356.68	9,112,346.84	8,194,608.69	7,868,686.30	2,532,553.28	214,840,722.14
Indiana	26,384,368.37	726,081.90	1,805,467.50	1,488,671.58	713,094.20	478,539.34	10,262,725.88	1,320,616.29	2,167,507.73	420,534.96	45,767,607.75
Iowa	12,854,337.96	708,069.00	3,708.57	418,324.45	652,552.70	235,911.78	714,965.31	843,216.92	1,293,796.36	221,321.02	17,946,204.07
Kansas	17,323,184.44	401,730.21	400.00	49,763.12	377,573.75	178,984.38	226,614.22	1,065,441.00	751,686.12	359,905.39	20,735,282.63
Kentucky	14,284,640.29	556,255.65	2,522,372.47	8,561,989.64	399,573.71	100,420.39	335,119.75	789,565.59	869,803.51	155,173.55	28,574,914.55
Louisiana	13,400,178.10	658,418.69	1,056,367.68	516,185.67	2,503,517.16	81,230.69	315,310.42	907,406.62	798,008.47	190,759.29	20,427,382.79
Maine	8,978,879.87	3,549,371.59	.....	67,882.31	147,223.40	21,104.73	125,370.07	506,458.95	496,437.93	53,173.89	13,945,902.74
Maryland	25,562,203.85	913,541.08	1,561,503.30	2,149,008.27	533,646.12	368,476.66	568,186.80	852,805.72	1,199,288.87	640,557.60	34,349,218.27
Massachusetts	109,857,344.01	7,547,053.27	1,160,604.23	1,737,881.27	2,023,286.50	1,360,692.26	5,739,056.45	4,737,261.99	4,655,132.78	463,341.97	138,681,654.73
Michigan	104,378,390.00	4,536,565.63	708,468.55	5,041,458.99	1,282,616.36	626,893.89	97,487,065.99	3,481,860.80	3,499,310.77	337,374.17	221,380,005.15
Minnesota	23,855,584.21	1,371,428.47	68,893.53	274,668.95	323,132.48	250,835.63	847,963.17	2,360,548.54	1,454,122.82	279,455.79	31,586,633.59
Mississippi	4,008,798.72	243,706.62	50.00	1,137.13	148,370.52	10,793.60	72,903.85	226,177.77	193,549.16	43,749.36	4,949,236.73
Missouri	44,116,410.10	2,138,173.62	405,417.71	11,193,683.60	1,183,755.33	1,755,915.54	2,486,876.03	2,453,989.05	2,444,141.82	616,125.12	68,794,487.92
Montana	2,060,349.38	50,912.77	5,295.41	18,423.67	89,045.12	12,218.38	61,512.13	302,557.29	324,031.39	33,693.54	2,958,039.08
Nebraska	7,458,788.40	475,226.54	697.75	94,410.52	388,922.87	685,894.63	356,954.40	459,714.27	769,386.33	101,619.90	10,791,615.61
Nevada	581,492.18	7,364.52	2,599.34	2,520.75	30,709.73	5,505.03	18,591.45	46,148.64	55,639.86	10,928.14	761,499.64
N. Hampshire	4,038,467.48	468,169.91	1,136.50	587,949.56	60,416.58	5,517.98	80,662.49	228,475.40	307,353.48	27,196.96	5,805,346.34
New Jersey	69,620,079.55	3,740,664.95	30,719.71	26,871,859.64	1,890,961.52	38,652.67	3,383,658.53	2,547,087.56	3,394,399.16	741,963.67	112,260,046.96
New Mexico	890,835.06	4,073.33	.....	1,067.88	39,469.71	4,975.80	20,750.48	76,622.30	87,015.13	6,513.99	1,131,323.68
New York	506,593,933.70	31,351,421.55	3,818,501.86	42,335,586.36	23,049,923.27	17,876,799.21	19,526,747.73	25,336,707.60	17,574,601.44	2,951,202.35	690,415,425.07
North Carolina	18,173,156.85	460,450.82	600.00	136,892,474.93	461,950.44	105,331.38	331,803.81	956,364.02	492,220.16	99,041.49	157,973,393.95
North Dakota	771,387.02	29,099.74	.....	4,846.19	95,756.37	26,924.81	41,323.46	134,939.24	161,374.04	17,188.04	1,282,838.91
Ohio	95,412,405.37	2,793,373.15	2,829,004.20	11,813,329.95	4,828,078.75	1,256,575.21	22,986,706.18	5,571,553.81	5,061,936.41	971,869.73	153,524,832.76
Oklahoma	11,028,491.98	139,035.53	406.25	21,786.57	402,664.68	124,519.27	161,187.27	863,208.93	641,906.10	137,356.56	13,520,563.14
Oregon	8,242,145.87	140,178.69	284.25	31,349.44	295,521.23	63,552.17	308,013.57	527,486.13	815,045.68	76,661.05	10,500,237.48
Pennsylvania	198,270,944.16	14,506,143.33	2,940,007.06	22,769,177.24	3,883,248.70	1,641,229.93	6,857,834.78	10,069,451.55	7,216,965.60	1,533,617.26	269,688,619.61
Rhode Island	16,241,809.18	2,097,417.42	5,911.52	75,227.73	188,352.39	10,375.23	199,487.24	698,071.24	672,612.37	50,089.41	20,239,353.73
South Carolina	7,544,042.97	249,469.70	350.00	127,320.18	213,927.38	23,368.43	156,660.44	368,980.42	209,589.03	44,570.41	8,938,278.96
South Dakota	1,169,750.72	68,422.59	12.50	45,344.95	121,366.44	75,117.12	108,985.67	134,251.37	201,061.03	26,936.56	1,951,248.95
Tennessee	11,943,033.92	480,750.85	825.00	3,824,560.71	487,728.31	59,311.81	512,434.03	608,584.08	584,710.31	131,707.10	18,633,646.12
Texas	28,295,285.81	1,165,365.85	13,420.32	159,673.49	1,197,593.09	421,639.52	945,853.14	2,034,652.57	2,179,036.66	451,237.59	36,863,758.04
Utah	2,937,172.54	104,068.69	150.00	26,034.46	125,627.05	18,795.75	196,450.15	359,919.86	285,994.34	32,974.12	4,087,186.96
Vermont	2,935,562.31	126,420.93	1,154.17	8,512.74	66,915.07	11,645.72	108,564.66	140,245.17	188,193.35	13,613.68	3,600,827.80
Virginia	16,048,299.83	989,118.03	4,842.33	25,324,100.23	588,654.98	36,704.42	371,048.92	1,290,911.04	697,807.58	140,399.62	45,991,886.98
Washington	14,723,370.45	497,818.95	125.00	34,540.77	473,273.48	152,467.96	594,249.62	1,127,789.13	1,294,190.73	108,182.70	19,006,008.79
West Virginia	14,386,962.07	547,012.43	847.78	2,444,404.11	408,151.77	37,339.28	281,810.60	1,038,825.40	675,634.19	74,479.58	19,895,467.21
Wisconsin	27,215,717.70	1,764,283.96	188,596.84	1,192,884.21	723,114.06	446,184.84	5,195,709.74	1,657,473.12	1,718,360.65	346,397.55	40,448,722.69
Wyoming	1,595,540.08	56,187.79	1,157.95	4,357.35	57,298.78	2,289.14	34,653.31	156,382.84	166,172.03	14,314.02	2,088,353.27
Hawaii	5,021,422.53	134,679.05	241.67	6,562.37	65,032.02	18,442.27	41,501.14	334,305.19	141,059.70	33,532.51	5,796,778.45
Totals	$1,817,404,764.76	$102,005,399.20	$27,542,992.61	$324,863,024.73	$61,994,576.67	$34,179,745.52	$200,600,129.45	$94,850,553.98	$84,838,011.02	$19,367,674.73	†$2,767,646,872.67

*Partnerships are not taxed as such except for War Excess Profits Tax of 1917.

†Does not include $28,532,384.39 collected from District of Columbia, Philippine Islands and Alaska.

stock and net profit is merely shown to indicate what enormous proof would pile up if a larger list of the 64,850 other corporations in New York was tabulated. Here is the list. Unless otherwise stated the net income given is for the year 1924. Remember that the Federal corporation tax has been paid before net income is tabulated:

American Railway Express—Net income, $2,950,000; operates in every State.

American Beet Sugar Company—Net come, $18,58',971.

American Can Company—Net income, $15,423,202.

American Locomotive Company—Stockholders in many States, total 11,754; plants in New York, Virginia, New Jersey, Pennsylvania and Canada; net income, $12,462,563.

American Radiator Company—Net income, $9,908,217.

American Smelting and Refining Company—Stockholders in every State, total 12,807; plants in Colorado, Utah, Washington, California, Montana, Texas, Arizona, Maryland, Illinois, Nebraska, Oklahoma, New Jersey, also Mexico and South America; net income, $22,471,506.

American Sugar Refining Company—Stockholders in every State, total 25,747; six northeastern States group have more stockholders than group in which New York is classed; plants are located at Boston, Brooklyn, Philadelphia, Baltimore and Chalmette, La.; also owns stock in beet sugar plants in California, Michigan, Iowa and Ohio; net income, $8,557,724.

American Telephone and Telegraph Company—Stockholders in every State in the Union, total 358,273; companies extending through the entire United States; net income, $144,954,889.

American Tobacco Company—Net income, $17,952,545.

Anaconda Copper Mining Company—Plants in Montana and Wyoming; net income, $18,599,971.

Buckeye Pipeline Company—Pipelines in Ohio; net income, $1,041,571.

Indiana Pipeline Company—Pipelines in Indiana; net income, $965,945.

National Biscuit Company—Net income, $12,092,828.

National Lead Company—Plants, 49, in various States; net income, $5,296,413.

Nevada Consolidated Copper Company—Mines and plants all in Nevada; stockholders in several States; net income, $2,620,797.

Pan-American Petroleum and Transport Company—No property in New York; net income, $13,011,215.

Postum Cereal Company—Plants at Battle Creek, Mich., and Windsor, Can.; stockholders in every State, total 1,500; net income, $2,881,466.

Sinclair Consolidated Oil Corporation—Stockholders over 41,000, living in every State; have refineries, terminals, bulk stations or service stations in nearly every State east of the Rocky Mountains; pipeline companies, Texas, Kansas, Oklahoma, Missouri and Illinois; net income, $29,737,887.

Tobacco Products Corporation—Controls United Cigar Stores Company and factories in Virginia; net income, $4,529,556.

Union Tank Car Company—Net income, $1,101,717.

Utah Copper Company—867,613 acres in Utah; owns Nevada Consolidated; majority of stockholders live in New York; net income, $12,140,261.

Utah Securities Corporation—Electric power, light and gas business in Utah, Idaho and Colorado; net income, $135,606.

Woolworth Company—Stockholders in every State; stores, 1,356; net income, $20,698,180.

Western Union Telegraph Company—Stockholders in every State, 26,138; maintains over 25,000 offices throughout the country; has over 1,500,000 miles of wire; net income, $15,915,756.

The Other Side of the Picture

Before concluding it is well that we take a glance at the other side of the picture. Parties who have been protesting that their State is being assessed by the Federal government to give funds to some far distant State seem to forget that it is the natural resources of that far distant State which enables her citizens to sit in their smug complacency.

Mines of Nevada, Utah, Montana and Colorado are emptied of their wealth, never to be reimbursed, and the profits go to residents of other States.

Insurance—fire, life and casualty—are much needed parts of our business life, yet New York, Hartford and Baltimore are foolish to lay claim to the prosperity of these institutions.

Boston is the center of our wool market, and yet the Boston "Common" cannot take the place of New Mexico, Arizona and Utah as a sheep pasture.

Knowing that all manufacturing in Montana last year paid out over $21,000,000 in wages and salaries alone, it is

astounding to note that manufacturing of metals and metal products for the entire State paid an income tax of but $17.

Business Centers Not State Owned.

Centralization of business in certain centers is a natural growth and economically sound. Surplus funds gravitate to certain cities, industries develop where power is cheapest or raw material nearest at hand. Water transportation cannot be developed around a desert town. Fertility of the soil is not the gauge of land values. The Federal Constitution, at the beginning, refused to curb domestic business relations and would not allow States to set up toll gates at State lines.

States do not own the corporations or the individuauls in their business relations. There is not a single large city in the entire country which secures its prosperity exclusively from the citizens who live in the same State in which that city is located. The poorest State helps to enrich the richest State.

That is a false theory which makes the claim that States contribute to the Federal Treasury. Federal funds should go for Federal needs, collected from all who have and expended so that all may have again.

ENFORCEMENT OF TRAFFIC REGULATIONS BY POLICE BUREAU

By L. W. McIntyre, Assistant Professor of Civil Engineering, University of Pittsburgh, Pittsburgh, Pa.

(The following paper by Prof. McIntyre was presented before the latest annual meeting of the National Highway Traffic Association.)

Traffic regulation as we know it today was practically unknown in the United States prior to 1900. Traffic conditions at that time, before the advent of the automobile, are described by a former police commissioner of New York City in these words, "The jostle and struggle between driver and pedestrian in the streets had been for many, many years a fixed condition, quietly accepted by the multitude. The driver, on his part, believed the street belonged exclusively to him, and, whip in hand, he sat on his throne as one beyond the law. As there were no systematic attempts to regulate his behavior, he pursued his brutal and savage way unchecked, with no respect for the law or its officers. The citizen went daily, with more or less courage, through greater perils and dangers than an arctic explorer, a sailor, or a hunter of dangerous wild beasts would encounter, glad at times to gain the curb, frequently escaping a violent and cruel death by a hair's breadth. It never occurred to him that the officers of the law had any authority in the premises, other than to occasionally help a crippled man or assist a helpless woman or child over some of the more dangerous street-crossings."

According to Mr. W. P. Eno, the first "police regulations" for the control of street traffic were promulgated on October 30, 1903, by General Francis V. Greene, then police commissioner of New York City.

However, as far back as 1861 the City of Harrisburg, Penna., had a traffic ordinance. On March 13th of that year the city fathers went on record to the effect "That if any person or persons shall ride on horseback or shall drive a carriage or sleigh through or along any of the streets, lanes or alleys of the said city faster than a common traveling gait, or shall drive his, her or their wagon or cart through or along the same faster than a common trot or pace, he, she, or they so offending, and being thereof convicted, shall forfeit and pay a fine discretionary with the mayor, not to exceed five dollars for each such offense, and costs of prosecution." The parking problem had also made its appearance at this early date, for we find record of measures in this same city designed to control the hitching of teams in the public square for unduly long periods.

But even this is comparatively modern. In June 1678, a resolution of the Assembly of the Colony of Rhode Island was passed dealing with the traffic problem:

"Whereas, there was very lately in the town of Newport on Rhode Island very great hurte done to a small childe by reason of exceeding fast and hard ridinge of horses in said town, this Assembly takeing the matter into searious consideration and being desirious for the future to prevent the like mischief, doe ordain, —et cetera—that from and after the publication, hereof, if any person or persons shall presume to ride on either horse, mare or gelding, a gallup or to run speed —in the streets of Newport—said person shall for his offense pay—unto the treasurer of said towne 5 shillings in money on demand; 2 shillings of which shall be paid to any person or persons that shall

give information thereof and the other 3 shillings to remain for the use of said towne."

It has been said that the curse of America is the desire for speed. If this is so the curse is of ancient lineage. If barely 70 years after the first permanent settlement on our shores it was found necessary to legislate against "speed fiends" their currency to day should not surprise us.

It can be readily seen then, why traffic regulation has become a function of the police department. The police were already organized to protect the citizenry from criminals. This same citizenry needed protection from the traffic hazard. Here was a protective body already functioning. What more natural, than that the regulation of traffic should in the short space of twenty years have become a regular, strongly entrenched feature of the police work of our cities? Any successful program for traffic regulation must be formulated on this basis. There can be no serious thought of taking traffic regulation out of the police department. Efforts should be confined to the question of improving existing police methods of regulation.

The Present Problem

Efficiency in street traffic accommodation must be sought in two ways: provision of streets and roadways adapted to the requirements, and the adjustment of traffic to make the best possible use of admittedly inadequate highways, where economic conditions make the betterment of these highways impossible. This problem must be viewed as a whole, and it must not be considered merely as a problem of providing for the automobile. We must remember that this traffic is of several kinds. We must remember that the street car, however obnoxious it may be to the impatient automobilist, carries *at least* 75 percent of the traffic in our congested areas. We must remember that the pedestrian is just as important and in greater numbers than the automobilist and he should be given just as much consideration, and as much regulation.

It will be readily admitted that the first aspect of this problem is of a purely engineering nature. It will not be so readily admitted, but I believe it to be none the less true, that the second aspect, that of traffic regulation and control, is also an engineering problem.

In the business districts, we must admit that the police handling of traffic, while fairly good in some cities, notably New York, is grossly inefficient in others, whether by reason of poor traffic rules, poor enforcement of rules, or both. It will take a much greater heed on the part of enforcement officers to the results of scientific studies and solutions to put most of our streets into anything like the measure of usefulness they are capable of. While I believe that traffic should be directed and controlled on the streets by uniformed policemen, I believe just as firmly that the administration of traffic departments or bureaus should be in the hands of engineers or at least of men who by long experience with this problem have acquired the engineering or analytical type of mind.

It is not referring disparagingly to our, generally speaking, quite efficient police forces to say that the policeman, even the present traffic officer, is deficient in ability to plan. He has not had the training which will enable him to quickly see defects in existing regulations, or if he does see the defect, he cannot as readily see and provide the remedy, as the engineer whose entire experience has been directed at analyzing defects and effecting solutions. Neither could the doctor, or lawyer, or plumber, or carpenter. But they may be none the less good doctors or lawyers or plumbers or carpenters. And so would the engineer be out of place in the enforcement of regulations. Here the policeman has had the training. But why not utilize the ability of both? The engineer to formulate the traffic scheme, the policeman to carry out the plan, with a type of organization insuring cooperation?

The field of effort is attractive, the necessities are great, and it is to be both desired and expected that more engineering talent will be drawn into it. Then there must be sufficient force to arouse public interest to the point of putting over the programs when they have been worked out.

The City of Pittsburgh, Penna., has recently further justified its reputation for being a live, progressive city, by being one of the first cities of the country to recognize the essentially engineering nature of the traffic problem. While in no other town are traffic policemen required to pay stricter attention to their jobs, nor is their problem more difficult than in Pittsburgh, last spring council established a Bureau of Traffic Relief with the following personnel; a chief engineer at $6,500, an assistant engineer at $4,200, a

statistician at $3,600, two draftsmen at $2,400, a clerk at $2,100, and a stenographer at $1,500, with adequate appropriations for expenses. This Bureau has just begun to function, and in cooperation with the previously established Police Traffic Bureau should be able to accomplish much. A closer relation in the matter of organization with the Police Traffic Bureau would probably have been desirable, but as a pioneer effort there can only be the highest commendation.

The Enforcement of Regulations

As has been indicated the enforcement of traffic regulations is quite properly a police function. There are, however, two schemes of organization to accomplish this end.

In some cities, men assigned to traffic regulation are carried on the rolls as patrolmen, and report in the districts in which their posts are located. In the larger cities, it is customary to have within the police department, a separate traffic bureau, under the supervision of a captain, lieutenant, or sergeant of police, and consisting of a number of specially detailed traffic policemen, either on foot, or mounted on horses, bicycles, or motorcycles.

The first plan has little to recommend it, for it makes it exceedingly difficult to train, discipline or control the traffic men. There is no uniformity of law enforcement. In one section of the city a speed of five miles over the legal limit may be permitted, in another ten miles, while in still another section, the legal limit may be strictly enforced. Under such a system men are rather freely transferred from traffic work to patrol work, and vice versa, and sometimes as a matter of discipline, and to the utter demoralization of the traffic work.

There should be a special traffic squad reporting, either to headquarters, or in the larger cities, to special traffic subdivisions, as in New York City. Responsibility and control over traffic officers is thus centralized. The collection and use of statistical material essential to the study of the city's traffic problem is facilitated. The specialized knowledge of the head of the traffic bureau can be utilized effectively, training schools for traffic officers can be established, educational campaigns conducted and an esprit de corps built up without which effective traffic work is impossible.

At present, even with this type of organization, details to serve on the traffic squad are given and revoked by the head of the police department. Under favorable conditions this is only done at the suggestion of the head of the traffic bureau. If he is efficient, he should be best able to judge of the qualifications of his subordinates for traffic work. If transfers are made other than on his recommendation, it will be practically impossible for him to maintain sufficient discipline to do effective work.

It would seem to be an improvement if the traffic bureau were recruited independently of the remainder of the police force and no temporary transfers permitted. The attitude of a large number of the men who come from patrol or detective work to the traffic bureau is entirely wrong. Their training has been in the handling of the criminal classes and the methods thus acquired are entirely unsuited to the work of traffic control. Automobilists and pedestrians are, as a rule, not criminals and are only too willing to assist the traffic men if given reasonable opportunity.

It is high time that it is realized that the chief objects of traffic regulation should be the *expedition of traffic with safety* and all provisions of traffic ordinances, or their method of enforcement that aim at objects other than this must be regarded as useless encumbrances. We have pretty nearly passed through the period of the making of traffic regulations. Many of the rules necessary for the rapid and safe movement of traffic are now almost as universally applied, understood and obeyed as the rule of keeping to the right of the road. There is little place for the blustering display of force on the part of traffic men, and I am glad to say that this type of officer is fast disappearing. Let us expedite his disappearance by making the traffic bureau an entirely distinct unit with its head responsible only to the chief of police.

To quote from Drapers "American Police Administration" "The desirable traffic officer never becomes excited under provocation, he presents a neat, alert, and military appearance; he constantly watches vehicles and pedestrians; he is thoroughly informed as to the rules in force and insists on their proper observance; he gives his signals clearly; he is familiar with the city and willing to answer politely and correctly the inquiries directed to him. Needless to say, by no means all policemen have these desirable traits. Hence, the selection of men for traffic officers becomes of great impor-

tance and their adequate training an absolute necessity."

The motto of the traffic bureau should be prevention, not prosecution. We need constructive rather than repressive programs. Traffic needs to be helped, not hindered. In some cities the salaries of traffic officers are contingent on the number of arrests made. Such policies lead to the "fining squire" and the "speed trap." In some smaller cities traffic officers operate only on Saturday and Sunday, and because of this method of payment, get quite a revenue. Motorcycle policemen should be uniformed and given a badge and should not operate in plain clothes. One uniformed policeman on patrol will do more good than ten hiding in ambush waiting to rush out on a violator. The police should "play the game." The average motorist wants the same thing that the traffic ordinance is designed to secure, safety and reasonable speed.

Mr. Benjamin G. Eynon, registrar of motor vehicles for the Pennsylvania State Highway Department, states an instance which illustrates very well the attitude when enforcement is left with the regular police force. He says: "Not long ago I was traveling at night on an open road. A machine traveling slowly was in front of me. The road was clear. I passed around him going 25 miles an hour. Almost instantly a red light was flashed in front of me and I jammed on the brakes. The car behind me, although it was going very slowly, grazed my rear fender because of the sudden stoppage. I saw a man, in citizen's clothes, with a red lantern. He had been holding it in a barrel until I was close to him. His companion was wearing a badge. He accused me of driving recklessly and in the next few minutes convinced me that he had not the slightest idea of the law he was trying to enforce. He had been put there by the burgess 'to stop reckless driving' because of an accident earlier in the day. The traffic officer should not be on the highway for the purpose of piling up cases before a nearby justice of the peace for the costs they are going to get out of it.

It seems extremely difficult to get out of the mind of the average policeman or police official that his function is to act as a restraining influence on the community. He has been a restraining influence for years in restricting criminal activity. He cannot get away from it. But when he goes into traffic work he must become an operating official and his department an operating department.

The expedition of traffic with safety, is the prime function of the traffic officer.

We can consider the railroad as a striking example of the difference in attitude. The railroad has its restrictions and traffic regulations also, and they are much more strictly enforced than any police traffic regulation. Does the engineer violate the speed limit? He is fined or suspended. Does he disregard the traffic signal? Well he doesn't repeat the process very often. But they also make a great effort to get the traffic through without undue restriction. We don't find the "fining spirit." The financial success of the railroad depends to a large extent on how well it succeeds in the expedition of traffic with safety.

Persons violating speed, parking and other lesser regulations are not guilty of a criminal offense against the city or commonwealth and should not be forced to experience the humiliation of being locked up in a cell. Reputable business men, who would shrink from any violation of criminal law, are often guilty of unwittingly or carelessly violating a traffic ordinance. If they are unable to place high forfeits, through lack of immediate funds, they should not be thrown in with criminals. On the other hand, we would have stricter enforcement in many cases if the patrolman—and there are a large number of real human beings on the police force—knew that the inconvenience and penalties inflicted were not out of all proportion to the offense.

Do I need to go further in order to demonstrate that the problems of traffic enforcement are of a nature entirely different from the usual police work and that in order to handle these problems successfully we should have a separate bureau where we can continually keep before the personnel the slogan (and I repeat it) "The expedition of traffic with safety."

The Police Traffic Bureau

Let us see what are the problems confronting such a traffic bureau, and how might it proceed toward their solution?

The organization of the bureau might well be into three divisions: (1) The planning or engineering division, (2) the operating or police division, and (3) the traffic court.

The Planning Division

The first or planning division would be manned entirely by engineers, for it is

here that all traffic regulations would originate, all mechanical devices for the regulation of traffic be designed, be tried out, installed and maintained; all one way streets be designated; all safety zones, loading platforms, play streets, no left turn points, and traffic lanes be established; all parking rules be instituted; and all systems of traffic control such as the rotary system, the block system, or what has yet to be tried out, the platoon system, would be studied, experimented with, and installed. Surely here is a highly specialized task demanding highly specialized training of an engineering nature.

I have maintained for some years that the traffic tower, which the great metropolis of New York has probably developed further than any other city has by no means reached the limit of its possibilities. It should be possible through accurate counting and charting of the traffic at each intersection to determine the exact length of time required for the traffic to pass that intersection, every way, at every time of day.

By a carefully worked out scheme of progressively changing the traffic lights along the main thoroughfare, instead of synchronously changing them, as at present practiced, traffic might move in platoons, so that a vehicle once having joined a platoon would remain in that platoon throughout the length of its journey. This platoon, having once started, would not stop until it had traversed the complete length of the main thoroughfare, except in case of emergency. Depending on the speed this platoon was permitted to have, either the maximum capacity of the thoroughfare could be obtained, or the minimum length of time taken to traverse the length of the thoroughfare. The slowing up effect of certain master cross streets like Forty-second Street would be minimized and traffic having passed the cross street would no longer be under its influence.

This is by no means a new thought, but we have not gotten very far toward trying out such a scheme. Might not one of the principal reasons be because there is not connected with our traffic bureaus, such a division of traffic engineers as I suggest, whose express business it would be to go out and get the necessary data in order to improve the existing method?

Such a division would make accident surveys, prepare accident spot maps, traffic movement maps, etc., thus greatly facilitating the work of accident prevention and planning for traffic.

Campaign of education would be conducted. Laws alone will not solve traffic problems. We need more cooperation, common courtesy and common sense on the part of the users of our streets and highways, both vehicle user and pedestrian. Obedience to traffic laws must be made voluntary instead of involuntary. Persons who would not think of cutting in at the head of a line waiting for theatre tickets do not hesitate to cut in at the head of a line of traffic, instead of waiting their turn. Through the medium of articles prepared for the newspapers, well designed signs, talks in schools and garages, much may be accomplished. The cooperation of mothers' clubs, safety organizations, Chambers of Commerce, motion picture houses, etc., can quite readily be secured. The New York Police Department has sent sergeants from the training school, to make talks in schools, garages, and livery stables. Such talks do much to bring the policeman out in the light of friend rather than prosecutor, and indicate a traffic bureau with the real spirit of helpfulness to traffic. The work of educating the public requires patience and perseverance and will only be successful in the hands of an organization with a sympathetic spirit.

Such a division because of its engineering nature would be in a position to cooperate efficiently with that other potent influence in increasing the traffic accomodation of our streets, namely, the city planning body, through the suggestion of streets, to be widened, cut offs to be improved, rounding of corners, circumferential boulevards to be constructed, establishment of parking accommodations, etc. Retail merchants complain that they cannot properly serve customers who drive. Business houses complain, and justly so, that adequate parking facilities should be provided before cars are restricted. It takes more than regulation to solve the parking problem. Its solution is largely a matter of cost. All should remember however that streets were established primarily for the passage, not stoppage of traffic. Parkers are enjoying a privilege, not a right. We may yet come to the point of requiring all buildings which are erected to provide within themselves adequate storage space for the automobiles of their tenants or of those who may have business in the building, just as they provide fire escapes or elevator service today.

A recent editorial in one of the Pittsburgh newspapers calls attention to the lack of marking of certain one-way and other streets in Pittsburgh, and to the fact that the motor clubs of certain western cities in routing tourists to the east suggest that they avoid Pittsburgh. With such a division in the traffic bureau such oversights should not occur. The editorial points out that "a little thoughtfulness, a little regard for convenience and comfort, counts for much in creating a good impression of any city."

The Operating Division

The second or operating division would be made up of specially recruited uniformed policemen. Most of these men would be on foot, for this type of officer is best adapted to controlling traffic at congested points. Officers on motorcycles are best adapted to handling the speed problem and for general supervision of traffic in outlying districts, while officers on horseback are best adapted to general supervision of traffic in congested districts. From their elevated seat they can much more readily detect violation of regulations and much more readily adjust traffic tangles. Moreover they are of considerable value in handling parades and unruly crowds. Such crowds are much more afraid of the hoofs of a well trained horse than they are of the foot patrolman's club. They should not of course be used for fixed stations.

The principal problem of the operating division will be the cultivation of the proper attitude of the officer toward his job, as previously discussed at considerable length. This can best be accomplished by the establishment of a traffic officers' training school modeled after the New York school. In the absence of such a school, as many of the responsible heads of the division as possible should be sent to New York to attend that school.

Such an organization need not, and indeed should not, prevent properly qualified officers from the regular force being assigned to assist the traffic bureau at certain periods of the day at some of the less important stations. Such work as the assisting of school children across the streets at the time of starting and dismissing of school may quite properly be performed by the regular patrolman. However during the time in which he is assisting traffic the patrolman should be definitely detailed to the traffic bureau and be completely under the supervision of the head of that bureau. The detail should be just as positive as if he were being transferred permanently.

And on the other hand, the patrolman should not feel that because there has been established a definite traffic bureau he should wink at flagrant violations of the traffic rules or decline to assist traffic in need of help. For this reason if for no other the traffic bureau should remain a part of the police department.

This division may quite properly enlist the help of outside agencies. It should also assist in the campaign of education. In South Bend, Ind., Boy Scouts were used to place cards in machines violating the rules. These cards called the attention of the violator to the rule violated and requested his cooperation. No arrests were made, of course.

Omaha, Neb., has, or had, a volunteer traffic squad of 180 men under 8 captains. Violators of traffic are given a card explaining the violation, a carbon being retained by the officer. A certain number of violations leads to arrest.

Another town, under the auspices of the Chamber of Commerce, organized certain school boy officers. These school boy officers reported violations of traffic rules occurring in the vicinity of their schools, together with the license number of the offender, to the Chamber of Commerce and the Chamber wrote letters to the violators cautioning them and asking for cooperation in helping to reduce accidents. If the same offender was reported three times he was called on the phone and told that the next offense would lead to his arrest.

Spokane has established a vigilance committee of 400 to assist the police. Members of this committee report violations to the police department, which warns the offender before proceeding against him.

In New York, I understand that motorists were for a time given traffic violation cards. These cards contained five blank spaces in which the officer had the option of making notations regarding minor violations of traffic rules, in lieu of arrest. When the card was full the option was removed and the arrest made mandatory. New cards were issued each year. Here is evidence of the spirit of the truly effective traffic bureau which recognized itself as an operating bureau.

Another method used to minimize the annoyance which would be caused by arrest for minor violations of traffic rules, and to yet bring the violation sharply to the attention of the offender, is the vehicle pound as practiced in Detroit, Grand

Rapids, Pittsburgh, and oher cities. In Pittsburgh the vehicle is tagged. If a fine is not paid within three days, the offender receives a summons to a hearing. The fine charged is, for the first offense, $1.00, for the second offense $2.00, for the third offense $5.00, and for all subsequent offenses $10.00. Records of all violations are kept by the controller and city treasurer, who notify the traffic magistrate if the fine is not paid.

The City of Pittsburgh also requires all drivers for hire to be licensed locally. If such a licensed driver is arrested, a letter is sent to his employer and a record or black list kept at the police bureau. Repeated violators are refused licenses, or if such a driver is convicted of a felony or a misdemeanor which in the judgment of the superintendent of police makes him unfit to be a driver of a public conveyance, his license will be revoked.

In Toledo, for certain of the more serious offenses, the driver is forbidden to operate his vehicle for from 30 to 60 days. His name, address, and number is also published in the police bulletin. A violation of the suspension leads to a jail sentence.

The Traffic Court

In many cities violators of traffic rules are given a hearing in the ordinary police courts along with violators of other laws and ordinances. In the smaller communities trials are in the justice of the peace courts, with the income of the justice dependent on the fines collected. In such courts quite frequently the title of the presiding officer contains the only reference to justice present. In other cities a regular traffic court is set up presided over by a rotation of magistrates from the other police courts. None of these systems for trying cases is desirable. At their best, the time of the violator is needlessly wasted in that he is required to first report to the police department and then to the court.

The answer to this situation is the third division of the traffic bureau, the traffic court. If the traffic court is not a part of the bureau it should function in close cooperation with it. There are traffic courts in Pittsburgh, Philadelphia, and other large cities. The magistrates who sit in them are paid salaries. Through experience they have come to understand the automobile laws thoroughly. Consequently motorists are given a fair hearing, and there is not the atmosphere in such tribunals that pervades the police and wayside courts, and that has aroused a storm of protest and drawn the fire of the motor clubs. The motorist who appears in one of the legitimate traffic courts has no occasion to feel that it is all a "frame up" to get the costs out of him.

By centering responsibility the use of political influence with the various magistrates in favor of certain offenders is minimized and enforcement is made uniform throughout the city. In Pittsburgh, there are two magistrates trying traffic cases, one hearing the minor violations, the other the major infractions, thus further expediting the handling of cases and insuring still more even handed justice. The traffic court is most effective when it is known that the presiding judge is absolutely impartial, inflexible, and unreachable.

That this court is of a higher order is shown by the fact that in Pittsburgh the traffic magistrates receive $1,000 more per year in salary than the magistrates of other courts.

The traffic judge should remember that many violations are through ignorance, not wilfulness. He should not take a pride in the figures showing the amount of money collected from motorists per year through the medium of fines. He should remember that violations may be decreased through education as well as fines. The Kansas City magistrate has the right idea. He says: "When a speeder was brought into court, and when, after hearing the evidence, I found that no one was injured nor any property damage sustained, and that the violation was the result of ignorance, I would continue the speeder's case for a week or ten days. During that period I would require the speeder to look up the statistics on insurance rates, the number of people killed and injured, the number confined in hospitals, the amount of money spent for graves and funerals, and would give him a pamphlet containing the traffic ordinance to study. When his case was again set for trial, he would be required to give me the information requested, and, under the instruction of a member of the Legal Department of the city, pass an examination on the ordinance. If it was shown that he had a clear conception of the ordinance and realized the seriousness of the situation, he would either be fined and paroled or his case continued pending good behavior.

"On one occasion a traffic student, after passing a good examination, suggested that all violators be required to direct

traffic, under the supervision of a traffic officer. This was done, and as a result I was given a number of valuable ideas, from which I prepared for the press a list of don'ts for car drivers and pedestrians, which together with the ordinance, were taught in the schools of this city."

Let me further emphasize the points developed.

(1) Tradition has placed traffic regulation in the police department. There can be no serious thought of taking it out. Efforts should be confined to the question of improving existing police methods of regulation.

(2) The problem concerns not only the automobile. The street car, carrying as it does, *at least* 75 percent of the traffic in our congested areas, and the pedestrian, must be given *equal* consideration, and also *equal regulation.*

(3) It will take a much greater heed on the part of enforcement officers to the results of scientific studies and solutions to put most of our streets into anything like the measure of usefulness they are capable of.

(4) The traffic problem is of an essentially engineering nature. Therefore, while traffic should be directed and controlled on the streets by uniformed traffic officers, the making of regulations, the planning of traffic schemes, and the administration of traffic departments or bureaus should be in the hands of engineers.

(5) Traffic control and the enforcement of traffic rules should be in the hands of a special traffic squad reporting either to headquarters, or in the larger cities, to special traffic subdivisions.

(6) It would seem to be an improvement over present methods if the traffic squad was recruited independently of the remainder of the police force and no temporary transfers permitted. The attitude of the traffic officer must be entirely different from that of the patrolman.

(7) The chief object of traffic regulation is the expedition of traffic with safety and all provisions of traffic ordinances or their methods of enforcement which aim at objects other than this must be regarded as useless encumbrances.

(8) The motto of the traffic bureau should be prevention, not prosecution. We need constructive rather than repressive programs.

(9) The motorist must be rescued from the "fining squire" and the "speed trap!"

(10) The successful traffic bureau will regard itself as a traffic operating bureau rather than a traffic restraining bureau.

(11) The railroad has its restrictions and traffic regulations which are more strictly enforced than any police traffic regulation. But we don't find the "fining squire" spirit. The spirit of the railroad is quite pronouncedly the expedition of traffic with safety. Traffic bureaus must operate in the same spirit.

(12) Violators of traffic regulations are as a rule not criminals; they must not be treated as such.

(13) The ideal traffic bureau might well have three divisions: the planning or engineering division, the operating or police division, and the traffic court, all under an engineering administrator.

(14) Might not the reason we have made little progress in developing the traffic tower along the lines of platoon control be that we do not have attached to our traffic bureaus in our large cities such an engineering or traffic planning division as I have suggested?

(15) Laws alone will not solve traffic problems. We need more cooperation, common courtesy and common sense on the part of the users of our streets and highways, both vehicle user and pedestrian. Obedience to traffic laws must be voluntary instead of involuntary. This will only come through campaigns of education, which is a function of the engineering division of the traffic bureau.

(16) It takes more than regulation to solve the parking problem. We may yet come to the point of requiring all buildings which are erected to provide within themselves adequate storage space for the automobiles of their tenants or of those who may have business in the building, just as they provide fire escapes and elevator service today.

(17) The principal problem of the operating division of the traffic bureau will be the cultivation of the proper attitude of the officer toward his job. This can best be accomplished by the establishment of a traffic officers' training school modeled after the New York school.

(18) The establishment of a traffic bureau should not prevent the regular patrolman from assisting traffic in need of aid or cause him to wink at flagrant violations of the rules.

(19) The operating division may quite properly enlist the aid of outside agencies both in the enforcement of the regulations and in acquainting the public with the rules.

(20) As a part of the traffic bureau or in close cooperation with it there should

be established a traffic court, with a salaried magistrate. Such a traffic court is most effective when it is known that the presiding judge is impartial, inflexible and unreachable.

(21) The traffic judge should remember that many violations are through ignorance, not wilfulness. He should remember that violations may be decreased through education as well as fines and should conduct his cases in the spirit of helpfulness to traffic so as to cooperate with the other divisions of the traffic bureau in the expedition of traffic with safety.

NOTES ON TOLEDO'S WATER SUPPLY PROBLEM

By W. J. Sherman, Consulting Engineer, Toledo, Ohio

Although much has been published as to the needs of the Toledo, Ohio, water works system and the various methods of supplying them, yet the writer believes that the public generally has a very hazy understanding of the real situation.

This brief article has been prepared at the request of a number of our public-spirited citizens, who are desirous of satisfying themselves and the public as to the true and correct solution of our water supply problem. It is entirely free from any personal or financial interests and is in no way connected with the litigation pending between the city and those interested in the preservation or abandonment of the canal.

The chief problem for solution may be stated somewhat as follows, viz.: How can we obtain a bountiful supply of pure and wholesome water at a minimum expense to the consumer and to the city?

If the writer understands the situation correctly, we now have and will have a bountiful supply of impure water so long as the mean level of Lake Erie extends up the river, past the water works intake and as far as the villages of Maumee and Perrysburg.

It is not now nor ever will be a question of volume so long as the present level of Lake Erie maintains, but rather is a question of quality, for the reason that the present supply comes direct from the river, a channel into which one-third of a million people are discharging all of their domestic sewage and manufacturing wastes. The same condition obtains in the west end of Lake Erie, which receives the waste of about two million people. As the population increases, these bad conditions will naturally become worse.

In this article we will not undertake to discuss the deficiencies of the distributing system, which—Topsy-like—has slowly developed ever since the plant was built many years ago.

Nor will we attempt to emphasize the undesirability of using filtered water for fighting fires in the business district, rather than utilizing and extending our splendid high pressure system. Instead we will confine our consideration to the water supply problem, which is in reality a great big problem, demanding solution.

The Toledo situation is somewhat analogous to that found among the cities and towns along the Ohio river below Pittsburgh, where the river water has become so badly polluted from domestic sewage and manufacturing wastes as to be practically unusable. A few weeks ago the city of Wellsville, some 50 miles below Pittsburgh, abandoned the river entirely as a source of water supply, in favor of a gravity supply from an impounding reservoir in the hill country back of the city. No pumping is required, not even for fires.

One can but wonder why the city of Toledo cannot obtain by gravity a far better quality of raw water than the present intake of the river affords, at the same time introducing enormous economies in the reduced cost of pumping and filtering.

Instead we find the city administration advocating the discharge of the entire flow of the canal into the river above Maumee, with a manifest purpose of permanently continuing the present plan of lifting the entire requirements of the water system some 70 ft. from the river level to the filter plant. This on the face of it is a very costly and wasteful procedure.

If it is practicable to utilize a supply brought to the filter plant by gravity and taken from the river at Grand Rapids, far above the existing sewage contamination, it would seem wise to do so.

Now let us consider the following brief resume of the essential facts affecting the situation, viz.:

(1) The Miami and Erie canal adjoins the filter plant property and flows within a few hundred yards of the coagulating basins.

(2) The flow line of the canal at this point is approximately 60 ft. above the river, from which comes all the present supply by pumping.

(3) This section of the canal is fed from the Maumee river at Grand Rapids, about 28 miles above Toledo. It should be and doubtless is far superior in quality to the raw river water we now obtain.

(4) The volume of flow entering the canal at Grand Rapids corresponds with the sum of the flows at the several power plants between Grand Rapids and Toledo. One of these was measured by the W. J. Sherman Co. in 1911 and in connection with our report to the city on the pollution of Swan and Ten Mile creeks and the sanitary problems of that portion of the city lying west of the river. At that time we found the discharge into Swan creek from the canal to be approximately 79,000,000 gals. per day. At the same time the Miami hydro-electric plant was taking more than 75,000,000 gals. per day. Service Director Jackson is quoted as having stated that between 50,000 and 75,000 gals. per minute (72,000,000 to 108,000,000 gals. per day) go into the river at Miami, while the average water consumption of the city is about 35,000,000 gals. Under date of July 6, 1925, Mr. R. T. Wisda, Assistant Superintendent, Division of Public Works, states: "Replying to the letter of the W. J. Sherman Co., inquiring as to the flow of water in the Miami and Erie canal between Grand Rapids and Maumee, Ohio, I beg to state that the normal flow is about 450 cu. ft. per second (290,600,000 gals. per 24 hours). This would indicate an abundance of water flowing in the canal channel to meet all requirements of the city for many years to come."

(5) There is a comparatively new concrete lock (dam) already built in the canal near the north side of the filter plant property.

(6) North of or below this lock (dam) it is four miles to the point where the canal discharges into Swan Creek.

(7) The "report of the Engineering Commission" (Messrs. C. H. Benzenburg, Allen Hazen and William G. Clark) appointed by the water works trustees in 1902 wherein was discussed at length the relative merits of the several possible sources of water supply refers to the Miami and Erie Canal in the following language, viz: "We further recommend that if at any time it should become possible for the city to secure the right to use water from the Miami and Erie Canal for a period of years in quantities sufficient to supply the consumption, a suitable connection should be made between the canal and the coagulating basins, and the supply be taken from the canal."

It would seem that the time has now come when the city can and should adopt the recommendation of the Engineering Commission.

The following tentative plan suggests itself after a careful consideration of the present conditions governing the water supply for the city of Toledo, viz:

(a) Abandon the canal between Swan Creek and lock No. 46 (the Filter Plant) a distance of four miles.

(b) Convert this section into a boulevard and extend it a short distance to a connection with Detroit Ave., thus giving us three highways between Toledo and Maumee.

(c) Make available at the Filter Plant the entire water flow which enters the canal at Grand Rapids by closing all the diversion channels at intervening points.

(d) Install equipment for taking water from the canal by gravity with a very low suction lift instead of from the river with a lift as at present.

(e) Retain and maintain the present so-called "low service station" for emergency use only, relying upon the canal station for the regular service.

In what has been said heretofore, we have considered only the subject of Toledo's water supply.

The Alternate Proposal

Before concluding the discussion of this subject, perhaps we should comment on the alternate proposal to abandon the canal entirely, and convert the right-of-way into a Boulevard from Toledo to Grand Rapids, a distance of 28 miles.

Admitting without question each and all of the many advantages of providing this community with another Boulevard outlet to the scenic beauties of the Up-River District, we still believe that the people of Toledo should be fully informed as to the sacrifices involved in such an undertaking.

It would mean the permanent rejection of the sanitary and economic advantages of a water supply by gravity from a point in the Maumee River 28 miles above the polluted effluent from the city sewer system.

In addition to having attention called to this mistaken policy, we think the tax-paying public should also be informed as to the probable cost of converting the canal into a highly improved Boulevard.

In the absence of detailed plans and specifications, it is manifestly impossible

to estimate this cost with any degree of accuracy. The danger of immature preliminary estimates is well illustrated in the case of the Summit Street Extension, which is reported to have cost more than twice the preliminary estimates of City Engineer McClure.

So one naturally hesitates to advance an opinion as to the cost of an undertaking of the magnitude of that under consideration, involving as it does, the Boulevarding of 28 miles of canal right-of-way.

If the paving project has an average width of 30 ft., the entire distance (wider for the first half and narrower for the last half) we have at once 492,800 sq. yds. of paving. This, at $5 per yd. will cost $2,464,000 plus the cost of filling, grading, drainage, landscaping and overhead, which conceivably would bring the total cost up to $4,000,000 or $142,000 per mile. These figures may be and probably are not far from correct, and they will serve the purpose of calling attention to one phase of this project which so far as we have noted, seems not to have been given any attention by its advocates.

It should be borne in mind that the project recommended by the Engineering Commission, permits the boulevarding of the first four miles of the canal as far as Lock No. 46 near the filter plant, and also a short extension of this Boulevard to a connection with Detroit Avenue, thus providing three separate outlets from the city to the Up-River District.

We cannot but wonder if our City authorities should no be content for the present with the work of improving these four miles of boulevard and those other 18 miles of unfinished boulevard comprising our present system, rather than to permanently reject the existing opportunity of obtaining by gravity a bountiful supply of water from the River at Grand Rapids with the attendant sanitary and economic advantages.

PREVAILING REQUIREMENTS FOR PAVEMENT GUARANTEES IN PRINCIPAL CITIES

By Walter E. Rosengarten, Traffic Engineer, The Asphalt Association, 441 Lexington Ave., New York, N. Y.

A quarter of a century ago knowledge of the technique of asphalt paving mixtures was understood only by a few engineers and paving experts who had devoted considerable study to the subject. There was little printed literature which dealt with paving mixtures and their stability. The result was that for many years, officials and engineers in general considered this high type of paving somewhat of a mystery. Specifications were not very exacting, laboratory equipment for testing materials was not generally available and considerable dependence had to be placed upon the contracting companies laying the pavements. The official or engineer was more or less at their mercy and simply trusted that a stable pavement would result. Nevertheless many pavements laid in those days gave excellent service and are still carrying traffic economically even though there has been a marked change in character and amount. This change, however, might be construed as a benefit to the asphaltic types as the increased kneading and compressing by the rubber automobile tires and greater loads tend towards more compact and stable mixtures, also the occasional dropping oils from the motors keeps alive and flexible the upper skin coat of the pavement.

In the early days a practice grew up whereby the official or engineer lacking actual knowledge of the asphalt pavements could protect himself and the community and insure having a high type smooth pavement for a long period of time. This consisted in requiring the contractor to guarantee his pavement over a period of from 10 to 15 years. If any repairs or maintenance became necessary during the period of guarantee the contractor was required to make them at his own expense. To cover this a guarantee or maintenance bond was given the community or a portion of the construction cost retained.

As more information on asphalt paving mixtures became generally available, engineers drew up more rigid specifications and testing materials became more usual. With better understanding and closer checking it was found that the long guarantee periods required were not so necessary and only tended to make the pavement more expensive, as the contractor had to add to his bid a contingent amount to cover cost of upkeep. With the more efficient design and inspection the community found that it could save money by assuming a greater responsibility for a satisfactory pavement, with the result that today maintenance guarantees have been reduced to five years and frequently less, with some communities taking over the entire responsibility

MAINTENANCE GUARANTEE ON PAVEMENTS.

City.	Guarantee Period. Asphalt. Years.	Other Pavements. Types.	Years.	Remarks.
Boston, Mass.	5	Granite block and wood block	5	
Fall River, Mass.	5	Granite block	5	
Lowell, Mass.	5			Contractor given option to repave street openings. Guarantee terminates on replaced area, and if a cost exceeds 50 per cent of area, guarantee in that block terminates.
New Bedford, Mass.	5			
Springfield, Mass.				City does its own street work.
Worcester, Mass.				All paving done by city.
Providence, R. I.	5			Bond required in amount of 40 to 50 per cent of contract.
Bridgeport, Conn.	5	No guarantee on other types		Maintenance bond required.
New Haven, Conn.	5		5	Bond required.
Albany, N. Y.	5	Same on all so-called permanent types	5	Bond required.
Buffalo, N. Y.	10			Bond required.
New York City				
Manhattan	5	Asphalt block Wood block Granite block	5 5 1	City retains 10 per cent of cost of pavement, and foundation also requires maintenance bond of 10 per cent.
Bronx	5			If guarantee expires during winter months it may be extended until inspection and repairs can be made, but not later than following April 15.
Brooklyn	5	Bituminous macadam Granite block	1 1	
Queens	5	Granite block	1	
Rochester, N. Y.	5	Same on all types		Retain 10 per cent of cost of the work, also require a maintenance bond of 10 per cent of the cost of work.
Syracuse, N. Y.	5	Portland cement concrete; brick and wood block Sandstone and granite block	5 2	
Camden, N. J.	1	Same for all types		Requires bond 100 per cent contract price.
Newark, N. J.	4	Same for all types		Requires maintenance bond of one-fourth of the total amount of bid. In addition, city retains 5 per cent of the total cost of the contract price; 2 per cent paid contractor at end of third year and 3 per cent at the end of fifth year.
Paterson, N. J.				Plan a four-year guarantee.
Philadelphia, Pa.	3	Granite block Wood block Vitrified block Bituminous macadam Portland cement concrete	1 5 5 1 1	1 to 5-year period for work paid for wholly by city and a 5-year guarantee on all pavements paid by assessment bills.
Reading, Pa.	1	Same for all types		Has been required for past 10 years.
Scranton, Pa.	5	Vitrified brick	5	Bond of one-half of the contract price required.
Wilmington, Del.				City does its own work.
Washington, D. C.	1	Same for all construction contracts		Bond of 25 per cent of contract required.
Norfolk, Va.	5	Other types	5	Bond of 35 per cent of bid remains in force for 5 years. Engineer is of opinion that time for guarantee is past.
Richmond, Va.	1		1	Increased to 5 years on many of largest asphalt projects. Difference in price 2 to 3 cents per sq. yd. for longer period.
Birmingham, Ala.	5			City requires bid on a price for 5 years maintenance, but reserves right to accept until final completion of road.

MAINTENANCE GUARANTEE ON PAVEMENTS—Continued.

City.	Guarantee Period. Asphalt. Years.	Other Pavements. Types.	Years.	Remarks.
New Orleans, La.	5	Brick Wood block Granite block	3 3 3	25c per sq. yd. is retained until the end of the maintenance period, on which 5 per cent interest is allowed.
Nashville, Tenn.	1			Guarantee bond required.
Akron, Ohio	5	Other types	2	3 per cent of contract price retained, on which is allowed 4 per cent interest, also surety company is liable to extent of 50 per cent of contract price.
Cleveland, Ohio	5	Stone block Brick Wood block	3 3 5	Contractor must deposit in bank as maintenance security 27c. per sq. yd. on asphalt pavements, 22½c. on stone block and 18c. on brick, also give contract bond of 50 per cent of bid.
Columbus, Ohio	5			Interest paid yearly to contractor on deposited maintenance guarantee money.
Dayton, Ohio	5 or 3	Same on all types		Extends for a period of 3 years, providing 5 per cent of contract price is left as a cash retainer and for 5 years if a maintenance bond of 25 per cent of contract is filed.
Youngstown, Ohio	5	Portland cement concrete	2 winters	Asphalt: Contractor shall give bond of 10 per cent of the contract, for the maintenance of pavement. Portland cement concrete: 5 per cent is required.
Chicago, Ill.				2-year guarantee period prior to 1923.
Detroit, Mich.	1 and 5			1 year for 6-in. base, 3-in. sheet asphalt top; 5 years for 8-in. base, 3½-in. sheet asphalt top. City contracts for no type of pavement other than asphalt.
Grand Rapids, Mich.	5	Brick Reinf. concrete	5 3	Guarantee bond required.
Milwaukee, Wis.	3	Stone block Brick Concrete Wood block	3 3 3 3	City retains 10c. per sq. yd. until the expiration of 3 years.
St. Paul, Minn.	5	Brick Creosote block Reinforced concrete	5 5 2	Portion of final estimate held in reserve for 1 year, also bond for 35 per cent of contract price required.
Minneapolis, Minn.				City does all work by day labor.
St. Louis, Mo.	1		1	Contractor deposits $200 with city for year.
Kansas City, Kan.	1	Same for all types		Contractor's bond covers maintenance; 5 years is sometimes agreed upon between property owners and city commissioners.
Omaha, Neb.	5	Stone block and vitrified brick Artificial stone and macadam	1 5	3 per cent of contract retained for the period of guarantee, in addition to maintenance bond.
Houston, Tex.	5		5	Applies to all types of permanent paving. Require maintenance bond 10 pct. of contract.
San Antonio, Tex.	3 to 5	Same on all types		Maintenance bond of 25 per cent required.
Denver, Col.	5	All types same	5	
Salt Lake City, Utah	1		1	If end of period is after Nov. 1 it is extended to following April 15.
San Francisco, Cal.				No guarantee required.
Los Angeles, Cal.				No guarantee required.
Spokane, Wash.				Maintenance guarantee discontinued.
Seattle, Wash.				Maintenance guarantee discontinued 1912.
Portland, Ore.	5	Same all types		

and requiring no guarantee. A recent study of this feature by The Asphalt Association which included specifications from many American cities of over 100,000 popuulation has revealed that in approximately 60% of the cities which supplied information a five year guarantee is now required. Only one city, Buffalo, N. Y., retains a 10 year guarantee, while Chicago and four Pacific Coast cities require no guarantee. Twelve cities or 23% require a guarantee of from 1 to 4 years. Four cities report doing their construction by force account. Investigation also showed that on brick and wood block pavements a similar guarantee was usually required. In several instances the guarantee periods varied for different types of pavements. The period of guarantee for other types being usually less than that required on asphalt pavements. In such cases the inconsistency exists of requiring a longer guarantee period on a type of pavement which has been in use for a long period such as asphalt with its demonstrated life, than is required on comparatively new types that have not demonstrated their serviceability.

Where various types are put in competition on a basis of first cost it would seem just that an equal period of guarantee be required on each pavement.

While there are many arguments in favor of eliminating guarantees entirely, it might be suggested that if the guarantee period were increased to something like 20 to 25 years, the bids on various types of paving could readily be compared, for they would give an excellent measure of the ultimate cost of different types of paving.

In order to insure that the maintenance guarantee is carried out a city usually requires the contractor to furnish a bond varying in amount from 10 to 100 percent of the contract price. Some cities require a cash deposit while others retain from 3 to 10 percent of contract until expiration of guarantee. At times a combination of both bond and retainer is required. Interests on the money retained is allowed the contractor by several cities. Details on the maintenance guarantee as required by 53 of the principal cities is given in the attached tabulation.

PRESENT CHICAGO PAVING PRACTICE

By John B. Hittell, Chief Engineer of Streets, Board of Local Improvements, City Hall, Chicago, Ill.

The following paper by Mr. Hittel was read before the Western Society of Engineers on Feb. 24, 1925.

Paving Design

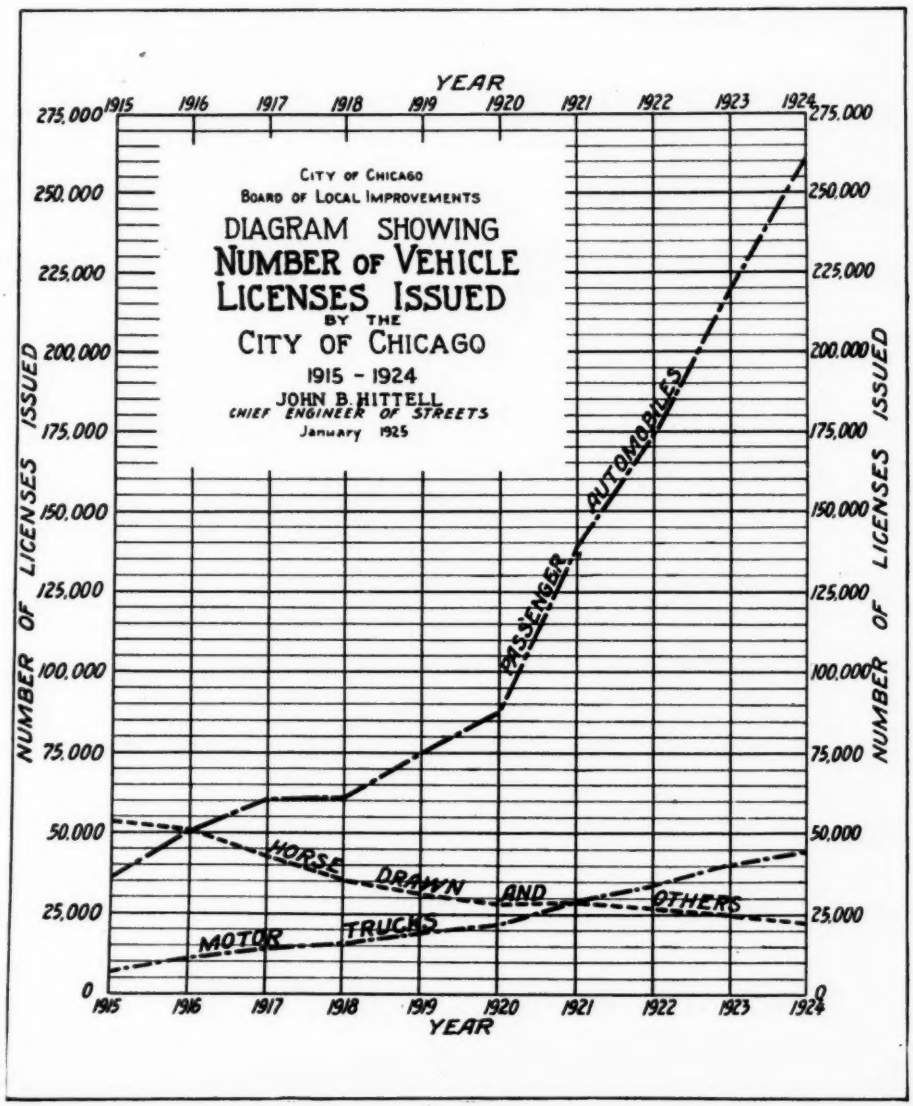
Among the general factors controlling paving design for the City of Chicago are: Traffic conditions, climatic conditions, topography, soil, and available materials.

Since the perfection of the internal engine, which made the automobile the popular vehicle for pleasure and the truck for commercial purposes, paving engineers must meet traffic conditions essentially different from those existent a few years ago. The steel tire, slow-moving traffic is replaced by one of great intensity, a high rate of speed and increased loads, but with the modifying effect of a non-metaillic and resilient tire, the latter at times equipped with chains. These conditions have resulted in eliminating the water bound macadem pavement and are demanding pavements with stronger foundations of the so-called rigid type, and more resistant surfaces in bituminous types, wider roadways, and concurrently regulation of traffic under police authority of the city.

The graph obtained from the license records of the City Clerk of the City of Chicago for the years 1915 to 1924 inclusive, Fig. 1, shows the number of passenger automobiles, motor trucks and horse-drawn vehicles including motor-cycles, bicycles, and sundry others. In these ten years, the horse-drawn curve drops from 52,500 to 22,500, or over 50 percent, while that for the motor trucks has increased from 7,500 to almost 45,000, an increase of 500 percent. The passenger automobiles have increased in this period from 32,000 to 260,000, or over 700 percent. The horse-drawn curve shows an almost uniform rate of decline and the motor truck an almost uniform rate of increase per year. The number of licenses issued for passenger automobiles in 1918 is practically the same as for 1917, showing the effect of unsettled conditions due to the call to arms. The years 1919 and 1920 show a uniform increase of almost 25 percent. From 1921 to 1924, inclusive, the rate of increase is almost uniform for each yearly period. If we take the motor trucks and passenger autos together, we will have a total of 305,000. This number

of automobiles, if parked four abreast, with an average of 20 ft. of roadway per car, would cover 290 miles of pavement; or if moving at 30 miles per hour assuming an operating space of 40 ft. per car, these 305,000 cars, four abreast, would require over 19 hours to pass a given point.

The highest temperatures reached throughout the six years 1919 to 1924 are very close together, ranging as they do from 94 degrees to 98 degrees. The variations in the minimum temperatures are somewhat larger, ranging from 1 degree to 16 degrees. The maximum daily ranges are very close together, approximating about 36 degrees. It is possible that there are larger ranges than this as these records are only from midnight to midnight. On February 8th, 1900, 25 years ago, the temperature fell from 62 degrees to 10 degrees in 15 hours, the greatest fall in history, with a wind that blew 62 miles an hour, a velocity exceeded but once. The maximum difference in temperature in this six-year period is 114 degrees, but as these records are taken at a point of observation which is above that of street level, it is fair to presume that a range of 140 degrees Fahrenheit is not an unusual condition for a pavement of the City of Chicago to endure,



especially if the surface is of the type or color that absorbs heat rays. Since concrete which is generally the foundation for an asphalt pavement has a coefficient of expansion about the same as steel, the contraction may roughly approximate 1 in. to 100 ft.

Aside from the Beverly Hills and Normal Park territory, the Clark Street and Ridge Road ridges and a few other spots, the topography of Chicago is quite level. The established grade at State and Madison is 14.0 above datum; at Irving Park and Broadway, five miles north, 11.0; at Kedzie and Madison, four miles west, 19.0; at Crawford, one mile further west, 24.5; at 47th and State, five miles south, 16.5; rising to 19.0 at 63rd Street, dropping down to 9.0 at 71st Street and reaching 8.0 at 87th Street, ten miles south of Madison. These small differences in elevation necessitate the draining of the pavements, by elevating the gutters at the summits, and depressing them at the catchbasin inlets. It is a rare case where drainage is obtained in our city pavements through a sufficient gradient of the top of the curb. This condition results in the need of constructing more catchbasin inlets than are necessary to take care of surface water based upon its volume, and has no small bearing on the ultimate cost of the work. Likewise it also causes the surface of the finished pavement to have a continuously changing cross-section. Hence it is difficult in construction to obtain a surface with a desirable minimum amount of irregularity as usually determined with a straight-edge.

The character of the earth foundation varies from the heterogeneous mixture of the debris from the fire, placed in that part of the city where the grades were raised about 4 ft. after that event; with sand and gravel extending along the lake shore, changing into blue clay further west with the outcroppings of rock in the neighborhood of 93rd and Stony Island and in the vicinity of Augusta and Western Avenue. In the loop district the preparation of the soil for a foundation is controlled to a great extent by the condition that the area cannot be long kept from use, and dependence is in general entirely upon rolling. When the soil is sandy, flooding is the most effective, and with clay flooding and rolling combined.

Chicago is fortunately situated concerning road making materials, as it has within a radius of about three hundred miles granite and trap rock, sandstone, brick, creosoted wood blocks, and beyond these limits rock asphalt is not very much further away; while within its local freight district are cement, sand, limestone, gravel, slag, asphalt, tar, flux oils. From this it will be seen that its location makes it possible to lay the accepted highest types of pavements without an undue increase in costs due to freight charges on long hauls.

The engineers in charge of paving divisions have had in the past rather a free rein in the physical design of the pavements, and from this has resulted, after trying out individual ideas, the present plan. The main idea of the plan is the level street intersection, no step or practically no step from the sidewalk onto the pavement at the curb line, and the drainage of the surface water from the street intersection toward the center of the blocks, eliminating the dangerous false gutters and humps in the pavement in the lines of travel.

To overcome the influence of the vibration of pavements occasioned by street car traffic, it is customary with asphalt and concrete types of pavements to lay additional rows of granite block lengthwise adjacent to the right of way paving of the street car company; and in some instances, this granite block pavement is separated by a header curbing of granite set on concrete in such a manner as to furnish a line of separation between this brow pavement and the adjacent roadway pavement with the view of localizing the effect of vibration to this brow pavement.

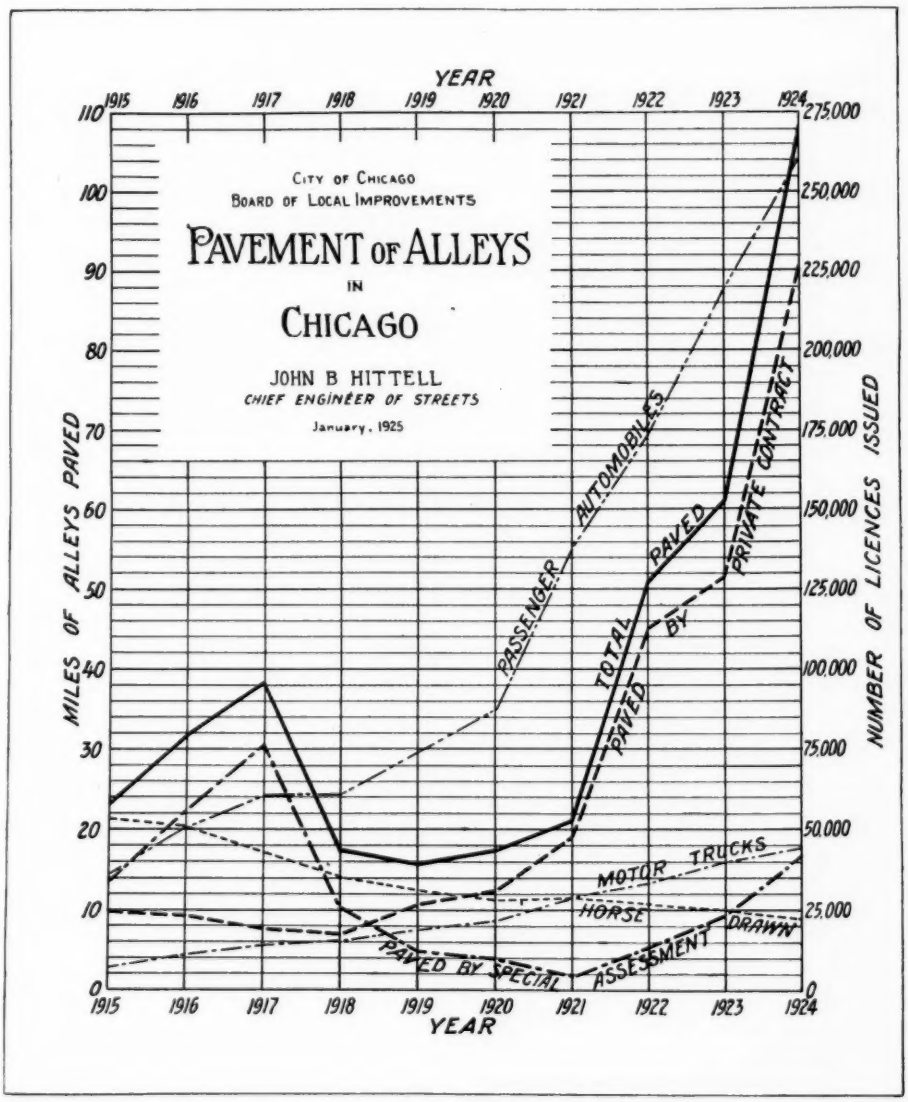
The general design of pavement cross-section has been of the crowned type. However, there are proceedings under way at the present time with the surface concave upwards, and sloping down from the curbs to a gutter at the center of the roadway. This design is economical in the sewer adjustment work, and as a lesser depth of curb can be used.

Conforming to the rulings of the courts it is mandatory that the ordinances for improvements under the Local Improvement Act should be so clear that one familiar with the type of construction could build the improvement from the conditions of that instrument. This, in effect, means that the ordinance combines a design and specifications. The writer has been advised by a consulting engineer and member of this Society who had occasion to make a study of the im-

provement acts in this and adjacent States that the decisions affecting those acts were in the ratio of ten in Illinois to one in any of the other States.

With the limited funds at the disposal of the Board of Local Improvements, in paving cases it has been the practice to avoid attaching any drawings to the ordinance, the preference being to attempt to describe in words all that is to be done. This description covers such minor details as elevations of gutters and crowns with reference to established curb grade, elevations of the outlet of the drain pipe from the catchbasins at its connection with the basin and sewer, and its direction; the location of expansion joints, catchbasin inlets, and the number of feet of pipe required to connect each one; and numerous other refinements of description which appear to engineers generally as absolutely unnecessary and too small to affect the estimate of cost.

Conversely, however, it must be considered that the Board of Local Improvements has great powers lodged with it to impose the costs of improvements upon owners of property and the latter are entitled to every protection in the application of the law. In the actual working of the law minor discrepancies



or omissions are constantly being used by skillful attorneys to defeat the confirmation of the improvement or to force a reduction in the assessment against their client's property. Many think that the present law of Illinois needs complete revision or that amendments should be made to it which would permit a correction of minor defects by a supplemental action of the Board of Local Improvements and the City Council. The present condition results in a situation where a large percentage of the preliminary work done in the paving department goes for naught.

With the advent of the present administration it was thought advisable to rewrite the present specifications for asphalt, asphaltic concrete and asphaltic macadem; and also to prepare a specification for portland cement concrete pavements for streets.

Believing that a multiplicity of council of those by whom the work in the future would have to be executed was advisable, conferences were held late in the winter of 1923 among the representatives of the Board of Local Improvements, Bureau of Streets, asphalt producers, paving contractors, including plant and street foremen, testing laboratories, interested trades unions and representatives and the Portland Cement Association, and from these many conferences the present specifications resulted.

Sheet Asphalt Pavements

In order to meet the demand in a pavement for a greater resistance to shoving and rutting, the specifications as adopted provided for a lower bituminous content, namely, heavy traffic streets, 9.5 to 11.0, and light traffic streets from 10.0 to 11.5, instead of as formerly, without a division for traffic conditions, of 11.0 to 13.5; similarly and respectively the 200 mesh dust content of 16.0 to 20.0 and 12.5 to 16.0 instead of 11.5 to 15.0; a more rigid sand grading; penetration reduced from a range of between 30 and 100 to a range of between 25 and 70. Special specifications were usually drawn for unusually heavy traffic streets. A greater initial compression was provided by a change from the use of a small roller to that produced by means of a three-wheeled roller, weighing not less than 10 tons, or a tandem roller weighing not less than 15 tons. The thickness of the wearing course was also decreased from a commonly specified thickness of 2 in. to that of 1½ in., and the binder course was increased from a depth of 1½ in. to 2 in. The size of the stone in the binder course was also increased and the grading changed to correspond. The mixture in the concrete base for asphalt pavements as well as for other types was changed from 1-3-7 to a mix approximately 1-3-6, requiring 4.2 sacks of portland cement to each cubic yd. of concrete in place. The upper surface of the concrete foundation was required to be roughened to provide a proper key for the asphaltic course instead of finished smooth.

Asphaltic Concrete

Changes in asphaltic concrete were practically along the lines followed in the case of sheet asphalt except that no binder was specified.

Asphaltic Macadam

In the asphaltic macadam pavement the foundations of 10 in. of water bound base are all now being laid in two courses, both of which are thoroughly bonded with limestone screenings. Graded slag is required instead of crusher run. Likewise the metal for wearing course was changed from limestone to trap rock or granite.

Concrete Pavements on Streets

A general design for concrete street pavements of a two course type without reinforcement was outlined by the Board of Local Improvements and the specifications were based on this design. Later on in a few instances, the Board has directed the laying of a one course pavement 6 in. thick of the vibrolithic type.

The mix of the two course pavement is approximately 1-2-3½ (requiring 6.4 sack per cubic yard of finished concrete in place) for both layers, using either limestone screenings or torpedo sand with limestone or gravel in the base. For the wearing course torpedo sand and crushed granite or trap rock is specified. The thickness of the wearing course is 2 or 3 in., and that of the base either 6 or 7 in.—a complete pavement of 8 or 10 in. in depth—depending upon the traffic conditions. The wearing course is laid within 45 minutes of the time that the base is laid.

Expansion joints 3/8 in. thick are placed across the concrete pavement at all street intersections in conformity with all curb lines produced; provided, that at the street intersections, where curb lines produced do not coincide and the interval between such curb lines produced is less than 20 ft., one joint only

shall be placed. Transverse expansion joints are also placed at right angles to the center line of the roadway across the concrete pavement between intersecting streets, at intervals of 30 ft., or as near as may be but not exceeeding 31 ft., measured along the center line of the roadway. A preformed joint filler is used.

Standard separation plates of number eighteen U. S. metal gauge having a corrugation along the center thereof, lapping 2 in. at their joints, and extending vertically from the base of the concrete pavement to within ½ in. of the top of the finished surface of the pavement, are placed along the center line of all roadways 20 to 40 ft. in width, which are without car tracks. On roadways above 40 ft. in width, additional lines of separation plates are used forming strips not less than 10 ft. or more than 20 ft. in width. On roadways with car tracks, 60 ft. in width or over, two joints are placed midway between the curb and tracks. A building paper separation plate, weighing 12 lbs. per 100 sq. ft., is placed between the concrete slab and the gutter.

Finish

Finishing by rolling and belting is done from the sides and from bridges. The use of a long-handled wood float is permitted where necessary. The edges are tooled along the gutters and expansion joints. As mentioned before the surfaces of the pavements have a continual change in crown in order to secure surface drainage. This precludes the use of the customary finishing machine and so our standard of surface finish is not as exacting as on country highways. The allowable departure from a 10 ft. straight edge is 3/8 in. We may also be justified in this because the allowable speed limits in the city are less than in the country. In one instance we have decreased the crown at the summit with pleasing results in the appearance of the street. Our mistake has been in having too much crown in concrete pavements.

Curing is done by the use of wetted burlap and the application of calcium chloride to the extent of two pounds to the square yard; or of silicate of soda to the extent of one pound per square yard, with the provision that when the temperature is above 80 degrees Fahrenheit, the silicate of soda may be reduced by the addition of 25 percent of water; or also at the discretion of the contractor, by covering the pavement with 2 in. of earth or wetted straw. Between July 1st and September 15th, the pavement is kept closed to traffic for 14 days, in other working periods 21 days. Woven wire fences are set the length of the day's run along the curb lines to protect the work from being marred by animals human or otherwise. On car line streets, unless other arrangements can be made with the operating department of the company, platforms extending the full length of the car and leading to bridges at the cross walks are provided at all car stops. These landings in turn are protected by a wire guard fence to keep the pedestrians on the platforms and off of the newly laid pavement. Additional foot bridges are provided where necessary at intersections. When car lines are opened to vehicular traffic, this traffic is kept off the new pavement by a cable, chain or railing supported by standards.

Alley Pavements

Referring to the chart on pavements in alleys, Fig. 2, the graph shows together with the number of licenses issued for automobiles, trucks, etc., the miles of alleys paved by special assessment and by private contract, and the totals for the years 1915 to 1924 inclusive. Here is markedly depicted the result of war conditions upon public improvements extending through the years 1918 to 1921 and the rapid increase following the improved conditions of the public in general since 1921. If a curve were shown including motor trucks and passenger automobiles the relation of that curve to that of total paved would be even more striking than that of passenger automobiles alone to the curve showing total paved.

Last year the number of alleys paved by special assessment was 132 and the number paved by private contract was 741, making a total of 873 alleys paved by this department in 1924. A mile of alleys requires 9,000 sq. yds. of paving. The business of alley paving has grown to large proportions and in the main is conducted by those who are well equipped by a thorough organization and up-to-date mechanical appliances and adequate capital. At times adverse criticism is made to the practice of issuing permits to pave by private contract. In order to obviate or reduce these to a minimum rigid regulations have lately been put into effect. The custom is sanctioned by law and the means to an end is justified. The large number of alleys so paved obviates the expense of special assessment procedure, which in the case of actual monetary expense to the City of Chicago,

in advertising, postage, and court costs, exclusive of engineering and clerical work is almost $20 per alley. If this alley paving were all done by special assessment proceedings, important street paveing projects would be curtailed or delayed unless a great deal larger force were provided. A small revenue also accrues to the city from the inspection fees which are paid by the contractor.

THE PROBLEM OF WATER SUPPLY FOR FIRE PROTECTION

By V. Bernard Siems, Water Engineer and President Water Board, City Hall, Baltimore, Md.

The following paper was read at the 1925 meeting of the American Water Works Association at Louisville, Ky.:

Our purpose here is to define the problem of water supply for fire protection and to sketch very briefly its various phases. Provision for fire protection should be an important concern of the water works engineer, for it is admitted that such protection is one of the purposes of a water works system and the good that results from assigning to it its proper importance far exceeds the cost entailed. It is, therefore, assumed that fire protection facilities are desirable on the water works system and the manner in which such provision affects the design of the system will be outlined.

Impounding Works

Impounding works are a factor of the problem in the smaller communities only. In providing impounding capacity for the smaller community consideration should be given fire safety as well as the protection of life and health during drouth periods affecting a community's source of water supply, for it is also necessary reasonably to guarantee the protection of a community's means of livelihood by protecting its plants and business concerns from destruction by fire. Therefore, sufficient impounding capacity for fire safety and also a proper means for bringing this supply to the community must be provided, especially in small communities, where little or no distribution storage capacity is provided, and in flat regions where probably there are no means of balancing the Distribution System, other than perhaps by a standpipe.

If no balancing capacity is provided, then sufficient pumping capacity should be provided for the peak load and in such cases adequate impounding storage is vital.

Feeder Mains

Feeder supply mains should be duplicate, guaranteeing continuity of service and this duplication should be carried out in supply lies, especially those leaving pumping stations.

Pumping Stations

Pumping stations should be equipped with a sufficient number of units to supply the required demand, peak load consumption plus the fire protection demand when the two largest units are out of service. Any portion of a water system depending upon a pumping station for continuity and sufficiency of service is particularly dependent upon the pumping equipment at the time of serious fire drafts, and the extent to which the safety of the community is centered in the pumping stations is of greater or lesser importance according to whether the system into which the pumped supply discharges is a tight one, or one balanced by a reservoir or standpipe.

A properly designed pumping station for either system of distribution—i. e.—tight or open—will be equipped with units of sufficient size to care for the ordinary consumption demands, with a margin of output capacity to care for at least 50% increase in consumption to meet peak seasonal loads, and to anticipate yearly growth. In addition to this excess capactity spare units and separate discharge lines will be provided entirely to duplicate the pumping equipment, so as to insure continuous service in the event of a complete breakdown to the units ordinarily operated.

In a pumping station discharging into a tight system, the 50% excess capacity, which conservative design dictates, will or will not include extraordinary fire flow demands according to whether or not the total daily output of the station is large or comparatively small and the area and character of fire risk included within the section served by the pumping station is large and hazardous or otherwise. With a normal output of 10 m. g. daily, the 50% excess will allow, under ordinary conditions, 3,500 gal. per minute to be used without affecting the domestic service, which may be entirely adequate for some sections, but insufficient for congested manufacturing or warehouse territory. These elements all enter into the question as to what extent provision must be made in the station design to care

for fire demands; if these factors determine that units for fire protection must be added to the station equipment, they must be of a type that can be brought into operation within the minimum time and designed for continuous full load duty, and, of course, installed in duplicate units.

In a balancing reservoir system, the question of pumping units for extraordinary fire flows is of less importance. The factors that determine the need of such equipment are principally those of standpipe or reservoir capacity, and size of mains from the reservoir to the area included with the district considered for fire protection. A well balanced distribution system will include mains sufficiently large to care for extraordinary fire flows, whether the pumping station that supplies the system is operating or not and for this reason the duplication of equipment in the station, plus the 50% excess capacity, will be sufficient for all demands that the station must meet at times of heavy fire drafts.

Distribution System

The distribution system should be well grided and supported by looped feeder mains, any of which may be shut down without causing a reduction in pressure on the system. Particular care should be given this phase of the problem. Grids should be designed so that the maximum demand may be placed upon them without serious reduction in the static head that theoretically should be maintained.

Reservoirs

Balancing reservoirs or standpipes, particularly on the ends of long feeder mains traversing congested sections where demands are high, seem particularly adapted to the maintenance of good pressures without the need of exceedingly large mains in the distribution grid, for it should be pointed out that the normal consumption can be supported by a distribution grid made up of mains considerably smaller than those required for adequate fire protection and any means of saving pipe cost without increasing friction losses or otherwise causing detriment to the service is desirable. With such reservoirs or standpipes on the ends of feeder mains, storage may be built up during the night periods of low consumption to maintain a uniform pressure during the day periods of high consumption.

Reservoirs are also important when the entire community cannot be supplied by gravity from the water source, but require more than one zone of distribution. Where the area served is not flat, but steep and the territory to be protected more extensive, sufficient reservoir capacity in the various zones of distribution should be provided to guarantee consumption demands for at least a five day period and the fire protection demand for a ten hour period, this provision being made not only to reduce the hazard of excessive drouths but also of failures of pumping stations. Supply lines from reservoirs should preferably be duplicate and to secure further duplication of supply it seems advisable to provide a number of smaller reservoirs rather than one larger reservoir whose capacity alone is sufficient. By dividing the required storage among several units greater protection against failure is secured. In flat country rather than reservoir capacity greater pumping capacity is required together with a well grided system of larger feeder mains leading from the pumping stations along arterial highways.

Pressure

High pressures are neither desirable nor necessary, especially since the automobile pumper is becoming a part of the regular apparatus of all fire departments. It is, therefore, better to provide main capacity than very high pressure and a pressure averaging 50 to 60 lbs. on a well balanced gridiron may be considered adequate, although in congested sections where the buildings are high a pressure of 75 lbs. is desirable.

Fire Hydrants

Having provided a main capacity and pressure, the spacing of the fire hydrants is of next importance. Bearing in mind that a discharge of at least 600 gal. per minute with a friction loss of not more than 2½ lbs. in a hydrant and a total loss of not more than 5 lbs. between the street main and outlet is required to adequately supply the standard automobile pumper rated at 750 gal. per minute, fire hydrants should be placed upon reasonably short branches and on mains of sufficient size to guarantee this discharge, considering the number of hydrants taken off between points of support. The actual spacing of hydrants—i.e.—the determination of the area protected per hydrant—has been established by the Fire Underwriters and their recommended spacing cannot be improved upon, although it is desirable further to recommend that hydrants be placed at inter-

sections to obtain advantage of the supported gridiron, and spaced systemmatically and symmetrically to facilitate the work of fire departments.

Valves

The best designed system is poor practically unless continuity of service can be assured. Failures of water mains are often experienced especially in congested sections where the fire risk is high. Therefore, valves on the distributing mains should be installed at intervals not exceeding 500 ft. in high value districts and 800 ft. elsewhere, while on feeder mains this spacing may be increased to a quarter of a mile. The scheme followed in Baltimore is to place valves every 300 to 500 ft. or at every intersection on the minor distributing mains; every 600 to 900 ft. on secondary supply mains, and every 900 ft. to a quarter of a mile on the primary feeder mains. The importance of valve spacing is commensurate with that of duplicate supply mains and looped feeder mains.

Therefore, reviewing various points to be considered in the relation of the water supply to fire protection we commence at the point of discharge; or in other words, at the fire hydrant. The number of fire hydrants may be determined by the quantity of water required for the adequate fire flow. This number dispersed throughout the area to be protected will in turn determine the proper hydrant spacing. With these discharge points established a gridiron may be discharged to equalize pressures and discharges sufficient for the demand. It is then simple to determine the required sizes of the secondary and primary feeders back to the reservoir which should be designed of sufficient capacity to meet the most severe conditions. In this respect one should not lose sight of the advisability of duplicate supply lines and counter-balance reservoirs, providing a supply to the system from opposite directions, nor should the requirements for fire protection be lost sight of in designing the impounding works and conduits which should be of sufficient capacity to maintain normal conditions during a serious conflagration during the drouth period.

Maintenance of System

The perfect system physically must be properly maintained, therefore, systematic maintenance surveys, such as pitometer surveys, for underground leakage, valve surveys, electrolysis surveys, pressure surveys and fire flow test surveys to determine the practical functioning of the system, should be continued without interruption.

Emergency Service

Proper emergency service should be provided at district stations, such as emergency corps and valve operating trucks provided with a fire gong, equipped to handle every type of work, ready at instant call througout the 24 hours.

The establishment of district yards in cities over 500,000 population is desirable for the purpose of providing quick and satisfactory service in emergencies.

Private Fire Protection Water Service

Now that some points, relative to the general water system, have been touched upon, consideration should also be given private fire protection service. A private fire protection line should carry a fixed service charge, although there should be no charge for the water actually used for the extinguishment of fires. Where a water works is required to stand ready to supply the demands that may be placed upon it by the private fire protection service, it should be compensated for this readiness to serve by the owner of the building benefited. The general adoption of such a charge for private fire protection lines might lead to the reduction in the number of sprinkler connections and to a reduction in the sizes of such services requested, but this would not be warranted.

After considerable study the Water Board of the City of Baltimore adopted regulations governing private fire protection water services, which are proving satisfactory both to the Water Department and to owner. These regulations provide that in all cases existing or future where a consumer maintains or applies for a water supply for private fire protection either of the following procedures shall govern; no charge in either case being made for water used in the actual extinguishment of fires in the plant. The significance of the particular type of fire protection service connection adopted in Baltimore is that they are combined domestic and fire protection services. A single connection is made to the City main and the service carried to the edge of the highway near which point the domestic service is taken from this combined service pipe. The usual valve is installed between the City main and the point where the main service is tapped for the domestic service, a valve also being installed on the domestic line

conveniently near this point. It is not permitted, of course, to tap these combined services for a domestic service whose size is sufficient seriously to affect the flow through the fire protection line —i. e.—to bleed this line in case of an emergency.

One advantage of such design is that the fire protection service and the domestic service enter the building or plant as separate pipes and the domestic meter and the check valve or meter on the fire protection line, which will be described later, are included within the same vault within the limits of the highway and are accessible outside the building.

Another advantage of the combined fire protection and domestic service that has not been mentioned is that the number of taps or connections to the City main are thereby reduced and the maintenance cost on services likewise decreased.

Another distinct advantage is that the domestic service by being taken from the main service pipe ahead of the check valve or meter on the fire protection line in these combined services, acts as a telltale upon the condition of the fire protection service by warning the occupant of the building of any stoppages on the main service pipe or shut downs on the City main. Then too, these services protect the department against unlawful use, willful or unwillful use of water, without hampering by any device the complete utilization of the line for fire extinguishment purposes.

Baltimore Rates

Before describing the procedure governing the combined services I will mention the scheme of rates in effect in Baltimore, in order that the method of applying a charge on the fire protection line may be more easily understood.

CITY METER RATES EFFECTIVE FIRST QUARTER, 1924.

$2.00 per 1,000 cu. ft. for first 5,000 cu. ft.
1.00 per 1,000 cu. ft. for next 45,000 cu. ft.
0.75 per 1,000 for all over 50,000 cu. ft.

Instead of a fixed service charge, there is applied on metered services a minimum quarterly charge, which varies with the size of the meter. These charges provide for an allowable consumption without further charge and are as follows:

MINIMUM QUARTERLY CHARGES.

Size of Meter, Inches	Rate	Consumption Allowed
⅝	$2.00	1,000
¾	3.50	1,750
1	6.00	3,000
1½	10.00	5,000
2	15.00	10,000
3	30.00	25,000
4	50.00	45,000
6	90.00	96,667
8	160.00	190,000
10	225.00	276,667
12	275.00	343,333

To resume the description of the procedure adopted in Baltimore for the two types of combined service connections provided are as follows:

(a) Where the owner maintains a sprinkler system or other appliance or appliances entirely within the building, the Water Department furnishes and installs on the fire line a check valve, Hersey or equal, with a by-pass meter at the expense of the property benefited. The domestic supply as described is taken off the main service ahead of this check valve. The sliding scale of rates is applied to the reading of the domestic supply meter, and the minimum charges are applied on the domestic supply meter and on the fire line by-pass meter considered as separate meters. The size of the by-pass meter on the fire line provided under this procedure is determined by the size of the fire line check valve as follows:

Where the size of the fire-line check is—	2″	3″	4″	6″	8″	10″	12″
The size of the by-pass meter in this setting on the fire line is—	⅝″	¾″	1″	1½″	2″	3″	4″

The other type—(b)—Where the owner maintains yard fire hydrants or other appliances for the extinguishing of fires outside of buildings, with or without sprinkler system, the Water Department furnishes and installs on the fire line a meter, Detector or Protectus or equal, of a size sufficient to pass the full flow of the fire protection line, with a by-pass meter as in Case "(a)", at the expense of the property benefited. The Domestic supply as in Case "(a)" is taken off of the fire line ahead of the fire protection meter. The sliding scale of rates is applied separately to the domestic supply meter and to any flow shown on the fire protection line through the by-pass meter, which would record any small flows through yard fire hydrants, for purposes other than the extinguishment of fires. The minimum charges are applied to the domestic supply meter and the fire line by-pass meter considered as separate meters.

The size of the by-pass meter on the fire line is determined by the size of the fire line meter as in the case of the check valve in Case "(a)" as follows:

Where the size of the fire-line meter is.	3″	4″	6″	8″	10″	12″
The size of the by-pass meter is.....	2″	2″	3″	4″	6″	6″

As to the permissible size of the fire line service granted, this size should

never equal that of the water main from which it is taken. The city main should always be large enough more than to supply the service required from it.

Much may be said of the relation of the fire protection service to the elevated tank for sprinkler systems where yard fire hydrants are or are not needed. A large fire protection service connection is to be preferred over the elevated tank in the first instance, as it is impracticable to secure a tank of sufficient capacity to supply a yard fire hydrant system adequately for any length of time, unless the supply to the tank is itself large. However, where the building protected is sprinklered an elevated tank is desirable, and I believe required by the Fire Underwriters, as a secondary service to guarantee protection in the event of stoppage of the City supply. Then too, where fire protection is the fundamental of distribution system design, in other words, where main capacity provided by the public supply and the pressure is sufficient, which condition may be found in some of the cities of which we have knowledge, it would be possible to supply sprinklers in certain sections, the height of buildings in which are limited by Zoning Ordinance, from the city mains; but in this case also the elevated tank is needed as the secondary supply for reliability.

The secondary supply is necessary for reason of the sprinkler system, whose purpose is to extinguish fires in the incipient stage. Therefore, the supply to such systems should be fool-proof and absolutely reliable. The sprinkler system is to control the fire when it begins and is not for the purpose of combating a serious conflgration, resulting from an exposure by an adjacent building which is burning. Therefore, for sprinklers alone, the elevated tank of sufficient capacity to supply the required number of sprinkler heads for 20 minutes at the rate of 25 gal. a minute a head, is more desirable than a large private fire protection line, as there is danger in the case of the large fire protection line bleeding the system main, if it should be broken. On the other hand, where it is required to supply a yard fire hydrant system, a large private fire protection service is important.

For the purpose of study, some consideration might also be given the use of the automatic control valves on the private fire protection service to guard against bleeding of the system in the case of the service being broken by falling walls. Such automatically closing valves, however, are unnecessary in cities providing an emergency corps of the Water Department who respond to all serious fires. In this case there is no need of the automatic device, as the valve on the service line could be closed by the employees of the Water Department.

The question of the private fire protection service is so important that many topics under its heading may be discussed. We have already touched upon the size of the connection, whether the domestic and fire protection service should be combined, whether the water purveyor should be protected so as to precent the intentional or unintentional use or waste of water through such connection, by whom the cost of installing the service should be borne, whether charge should be made for the service and how such charge might be applied, what control should be placed upon the pipes in case of breakage, and the difference in requirements between the yard hydrant system and the sprinkler system.

One other topic is important—i. e.—the means that should be adopted to prevent the pollution of a public water supply through an independent private fire protection system, which may be connected to the fire protection service from the public supply.

It is not desirable to have any mechanical connection between the private supply, which is usually raw polluted water and the public water supply, even though such connections may be protected by more than a single check valve or positive acting gate valve for there are many cases on record where the public water system has been polluted through such connections. Where it is desirable to have an augmented fire protection service—i. e.—one supplied by the public mains and a private source as well, the public supply line should be made to discharge into an elevated tank above the water surface, this tank supplying the private fire protection system.

High Pressure Water Systems for Fire Protection

Much thought has lately been given high pressure water supply systems. It is doubtful if a separate high pressure system is economically desirable, for it seems, after the experience of later years, that the same protection could better be furnished from the properly designed general distribution system of the com-

munity. However, where there is storage capacity provided on an abandoned water supply, which could be brought by gravity to the section to be protected, it would be advisable to construct a distinct high pressure gravity system for the utilization of this untreated supply. The maintenance of such system would not be so expensive as to prohibit it.

Zoning

The real problem is the determination of the future requirements of the community to be supplied, for at this time economics is given the consideration it deserves in the design of the water systems by water works engineers. It is almost impossible for the engineer to anticipate the development of a community. Therefore, it is most important that the community be zoned in order that its development may be regulated by governmental process. Zoning provides for the engineer not only a clearly defined picture of the nature of the demand which will be made upon the water supply, but defines this picture by giving such details as the height and bulk of buildings, the area of clear spaces and highways which become factors in estimating the probable future fire flow requirement, for the required fire flow is the maximum demand that will be placed upon the water supply. It is true that the effect of zoning cannot be felt immediately in a city already established, but although its ideal is not at once realized, the ultimate effect of this regulation of the growth of a community gives reliable aid to the engineer in closely approximating the development trend from field observations. This relationship between zoning and water supply should be clearly established in the minds of water works engineers and in the minds of municipal officials. As has already been pointed out by a member of the American Society of Civil Engineers in a recent paper on this subject (H. Malcolm Pirnie), "Stability in existing water works structures and in present provisions for the future water supply of a community is dependent on stability in building, and may be secured by the early adoption of a carefully prepared zoning plan and ordinance.

"In preparing a zoning plan, the water supply must be given due weight with all other purposes in view. Water has been and still is about the cheapest of all public necessities. Its cost in the future, however, will be greatly increased in some communities if the city plans are made without consulting the water authorities. It is possible even to destroy an existing source of water supply by disregarding this phase of the problem, thus burdening the city with a cost for new works out of proportion to the benefits resulting from zoning."

Associations

Finally, the water works engineer should endeavor to secure the cooperation of the chief of the Fire Department in his community and there should be a more liberal understanding between the Water Works Official and the Association of the Fire Underwriters. So many times the requirements demanded by the Fire Underwriters exceed the demands for which the water supply can be economically designed, and whereas the writer has always received hearty cooperation from both the Engineers of the National Board of Fire Underwriters and the local associations, nevertheless, he believes greater liberality on the part of each would be beneficial.

COURT SUSTAINS PATENT IN PNEUMATIC METHOD OF PLACING CONCRETE

(Editor's Note: On account of the very extensive use of the pneumatic method of placing concrete lining in tunnels and other difficult work, our readers will be interested in the decision just returned by Judge A. N. Hand, of the United States District Court, Southern District of New York, validating the MacMichael patent, owned by the Concrete Mixing and Conveying Co. of 9 So. Clinton St., Chicago. The suit was between the Concrete Mixing and Conveying Co. as complainant and the Uler Contracting Corporation and Shandaker Tunnel Corporation, defendants. The decision of Augustus N. Hand, District Judge, follows in full.)

This is a suit for infringement of U. S. Letters Patent No. 1,127,660 to John H. MacMichael, granted February 9th, 1915, Claims 2, 4, 6, 17, 21, 22, 28, 34, and 35.

The invention has for its object to provide a method of an apparatus for elevating and transporting concrete. The Patentee describes concrete in the specification as "a composition containing relatively large pieces of rock or stone as uniform in size as possible, together with predetermined proportions of sand, ce-

ment and water." Pneumatic pressure is used to compress the concrete into a restricted conduit pipe and then additional pressure by means of a jet of compressed air is applied to the mass near the entrance of the conduit pipe, thereby pushing the mass into and along the conduit. The MacMichael invention is a most interesting one and has apparently met with general acceptance. Engineers at first distrusted the possibility of lifting and conveying concrete large distances by the MacMichael device. The very material would be likely to clog any long pipe line. Moreover the weight would be so great if conveyed as a mass by means of pressure from the rear, that too great pressure for safety would be required, if, indeed, enough could be applied where the distance was long and concrete, as in some cases, was lifted 80 ft. Various attempts to convey sand appear in a number of patents, and in the Goldie Patent No. 707,840, sand was ejected under railroad ties by steam pressure.

In the Farnham Patent N. 747,396, there was a sandblast apparatus shown where the sand was carried into the discharge pipe by gravity aided by compressed air and then ejected by an air blast nozzle entering the discharge pipe in the general direction thereof. The patent to Sticker No. 758,118 is likewise for a sandblast.

None of these patents, in my opinion, would teach anyone with imagination and talents short of a real inventive faculty to install a conveyor which would obviate the delay and expense of laying concrete by hand about the forms on which a tunnel is built. They were kinetic devices for floating light materials. This was in substance so even in the case of the Goldie patent where dry cement, or cement mixed with sand or gravel, was ejected from a short hose by an air or steam waterblast. It is not accomplished by a heavy air pressure as in the patent in suit, but by air or steam velocity.

In the MacMichael patent the second blast of compressed air at once cuts the concrete mass and shoves along the segment of concrete. The segment to be shoved along is of comparatively small weight and dimension so that it can be carried without clogging the discharge pipe. Mr. Kirkland, the chief engineer of the complainant, described this at page 9 of the record:

Q42. What is the effect as you have observed the operation of the machine of working the jet at the bottom directed at a line or an angle to the travel of the material in passing from the main vessel? A. The air brakes up or penetrates the mass as it goes toward the outlet, detaching portions of it, so that these portions will present a surface to the oncoming booster jet so that they may be forced through the pipe.

"Q43. And are these batches solid or in detached portions? A. They come on in waves. Sometimes the successive portions of each batch follow each other so rapidly through the pipe that to the casual observer it would be almost impossible to tell whether it was a continuous stream or successive batches, but in long pipe lines, the successive batches are more pronounced and one observing them will note a wave,—that the material comes in waves.

"Q44. How far has concrete been conveyed and placed in this apparatus from the apparatus itself? A. On the Twin Peaks tunnel in San Francisco we placed it at a distance of 4,900 ft. from the machine."

Mr. Bateman, the superintendent of the well known contractors Booth & Flinn, confirmed the foregoing testimony as to the discharge of the concrete from the complainant's machine in sections.

Complainant's expert, Frederick Ray said:

"The net result of that is that it is possible to handle this concrete in slugs through a long pipe with a comparatively low pressure of air, that is, a pressure of air around 100 lbs. whereas to force it as a continuous stream through such a pipe, might take thousands of pounds or it might even be impossible, but certainly concrete can be forced through a certain length of pipe." (Minutes p. 91.)

Mr. Ray points out the portion of the specification which indicates that the inventor understood these advantages of his invention. MacMichael says at page 2, lines 45 to 100 of the specification:

"It will be observed that the upper air pipe 8 serves merely to supply air to the upper part of the chamber 1, the pressure of the air being uniformly applied over the entire upper surface of the mass. The lower pipe 10, however, serves to direct a jet of air moving at a considerable velocity directly against portions of the mass as they move toward and into the discharge duct. The two pipes thus

act in very different ways, the upper pipe supplying air which acts by pressure and the lower pipe supplying air which acts by velocity. On account of the presence of large and small particles, and on account of the presence of water, a mass of concrete-forming materials (whether completely mixed or not) is relatively compact and impervious to air, and on this account the upper air body acts by applying a uniform pressure to the entire upper mass surface and without any substantial penetration of the air itself to the interior of the mass. Air from the lower pipe 10 may force itself into the body of the mass, and the relatively small air jet acting upon the relatively large stream of outward moving materials directly engages with the submasses to push them along. This action of the two air bodies in my apparatus is to be contrasted with the action of air in earlier devices which were so constructed that light materials such as grain or ashes could be caught in large moving air bodies and carried along in suspension with each particle separated from the others. One of the strongly marked and novel matters incident to this provision of the pipe 10 for introducing air directly into the discharge pipe, whether considered by itself or considered as supplemental to the agency such as the air from pipe 8 tending to effect downward and forward propulsion of the entire mass, is this, that the rapidly moving air from pipe to pipe acts upon sub-masses, successively of the general mass, at points near those where they enter to delivery pipe, the result being that the thorough commingling of the ingredients (rock pieces, sand, cement and water) well understood by the engineer to be essential to a perfect concrete, can be attained with great rapidity and with a perfect, uniform, distribution of the various ingredients as concerns the relative positions of all the component particles."

A device for transporting sand, ashes or coal even by means of an apparatus having a structural resemblance to complainant's device we find furnishes no anticipation of the patent and MacMichael's conveyor when applied to concrete is not objectionable as a double use. Concrete Appliance Co. v. Meinken, 262 Fed. at p. 964.- As Judge Denison remarked in the foregoing case:

"Certainly the art of loading coal into a ship for fuel is not the same art as that of distributing wet concrete to a building structure; nor is the analogy very close." See also Hobbs v. Beech, 180 U. S. at p. 389.

The appreciation by the inventor of the necessity of limiting the concrete to be conveyed to sections of moderate size and weight and his method by the second air jet of securing the cutting off of a segment from the mass of concrete and a propulsion of this segment through the discharge pipe involves invention of a high order. His device has displaced all other methods for rapidly and economically conveying, lifting and placing concrete at long distances from the initial source of supply and has been used in numerous great enterprises. In such circumstances his claims should be read broadly and given a range of equivalents. When so read I think the defendants plainly infringe.

The process claims are limited to no particular form of apparatus so that the contention that they are for a mere function seems without merit. Expanded Metal vs. Bradword, 214 U. S. 336; Buffalo Forge Co. v. City of Buffalo, 255 Fed. 83.

I find claims 2, 4, 6, 17, 21, 22, 28, 34 and 35 valid and infringed, and grant an interlocutory decree to the complainant with the usual reference.

SAN FRANCISCO SURVEY FOR SCHOOL ACCOMMODATION

By Guy Wilfrid Hayler, Assoc. M. Am. Soc. C. E., City Planning Engineer, 453 Thirty-Fourth Ave., San Francisco

The Education authorities of almost all growing cities are constantly confronted with the problem of making the schools fit the increasing juvenile population. The cities that have made beforehand, comprehensive city plans for their entire development and have included school extensions in them are to a great extent, exempt from this difficulty but so many so-called city plans are no more than shadowy attempts at spectacular planning and woefully ignore schools and their locations. So generally speaking the vast majority of American cities jog along in a hit and miss fashion with their school problem, with diastrous results all round, first to the children, second to the districts immediately concerned and lastly to the general body of taxpayers who have to foot the bill. The very fact that money is voted for new schools, and new schools are built, is no guarantee that a sensible and economical approach has

been made to a solution. Indeed in many cases it is not only extremely wasteful expenditure of public money but still further aggravates the trouble.

The writer was recently commissioned to make a school survey of the City of San Francisco with a view to establishing the facts relating to the capacity of schools and present and future population, and the methods used in the study may be of interest to other communities.

In the first place it should be noted that San Francisco has no City Plan established for its future development and no plan for school locations to accommodate populational changes. The fire and earthquake disaster of 1906 destroyed a large number of schools and although much public money has been expended since that date, the school situation is still very unsatisfactory coupled as it is with increasing population since building operations were resumed at the close of the World War. The latest attempt at solving the problem was the sanction of a Bond issue of $12,000,000 in 1922 to build new schools.

The number of existing schools is 107, comprising 89 elementary schools, 3 junior high schools, 7 high schools and 8 special schools. The new housing accommodation will be 11 elementary schools, 2 junior high schools, 4 high school extensions and 1 elementary school extension. The present seating capacity of 55,476 will be increased by 464 after deducting the seats of old buildings which are to be scrapped. These figures together with the fact that at present 4,184 children are housed in temporary wooden shacks emphasizes the complications with which the study was concerned.

The Survey Report covered 3' days and was supplemented by 5 plans, 91 graphic diagrams, 6 statistical tables, 5 illustrations and 6 appendices. Three of the plans were prepared to large scale in color and portrayed the existing situation, the new school housing and the anticipated position next year and in 1927. The use of colored plans and graphic diagrams better explained conditions and trends than the compilation of unwieldy written matter.

The outline of the Report was as follows:

1. Object of Survey. 2. General methods of Survey. 3. Use of plans and graphs. 4. Population Statistics and Estimates. 5. School analysis. 6. Bond program analysis. 7. Relation of schools to street traffic. 8. Topographical Conditions of School Sites. 9. Effect of general city improvements. 10. Commercial and Industrial expansion. 11. Apartment Houses. 12. Developing Residential Estates. 13. County Schools (an aspect of City annexation). 14. Summary and Conclusions.

The determination was first made of the seating capacity of existing schools and the estimated number belonging, the latter figure being arrived at by examination of attendance statistics. Next, an exhaustive study of all available population figures was made. Then the new building expansion, the amount of land outside a school population and the areas still open for residential property. The vacant land was systematically visited and studied and the plans showed the complete range of future building which would harmonize with the homing requirements of the city. The foundation was then laid for determining the future population of the city and in doing so, the typical housing capacities were studied with the trend of single and multiple dwellings and the engulfing of old residence areas by industries.

From this data it was possible to arrive at a fairly accurate estimate of the present populational distribution and observe how school areas overlapped and were wasteful in their location, how schools were not centrally located and how topography was not rightfully considered in school location—a vital element in a hilly city.

The report emphasized the necessity for a definite school system planned on comprehensive lines in accord with city development. There are few aspects of the modern mnuicipality so vital as scientific school planning. The enormous expense of great school buildings with all their equipment justifies every effort made to derive the very last cent out of their cost and maintenance. This can only be done by judicious expenditure based on experienced guidance by those who are familiar with the multitudinous influences which determine the development of cities.

The San Francisco Survey was undertaken on the initiative of Mr. Ira W. Coburn who was formally a member of the City Planning Commission and who has recently been elected a Director of the Board of Education. It may be said to have been the first School Survey of its kind in San Francisco, undertaken with the relationship of schools to city planning as a basis.

BUSINESS FOLLOWS LIGHT

By L. A. S. Wood, Manager Street Lighting Section, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

A brief study of the history and development of street lighting will assist us in understanding the relative functions of municipal officials, progressive business men and the taxpayers in relation to street illumination, and enable us to determine the best way to promote a modern street-lighting system, which will not only be adequate and ornamental, but which will be adequately maintained after it is completed.

Experts tell us that the earliest recorded municipal street-lighting system dated about 200 A. D., when lamps were hung before the doors of the houses on the more important streets of Rome. A search into ancient Grecian history, however, places the origin of municipal street lighting at a still earlier date. We are told by historians that a well known philosopher named Diogenes, was observed wandering about the streets of Athens carrying a lighted lantern. When questioned as to his purpose in such action, he replied that he was looking for an honest man. Of course, it was immediately understood that he was seeking the Mayor, or some other important civic functionary, and no self-respecting city could permit a condition to exist whereby an eager citizen was forced to adopt so antiquated a contrivance to find his way to the City Hall. Thus, from purely selfish motives, city officials became interested in street lighting.

Street lighting in America followed closely the development of the whale oil industry, and whaile oil became the principal source of illumination until displaced by mineral oil or natural gas in the early part of the nineteenth century. In 1879 the electric arc lamp made its first appearance on the streets, and from that time forward street lighting became a recognized function of the municipality. Such lighting was purely utilitarian, however, and generally resolved itself into the suspension of arc lamps at street intersections. The lighting systems were usually installed by public utility companies and maintained by them under contract with the municipality.

Until the advent of the automobile, this class of street lighting which the late Dr. Sinemetz characterized as "distributed darkness," was sufficient for its purpose and served to illuminate street crossings and define the roadway. Modern traffic conditions, however, call for higher intensities of illumination and for systems which will not only light the streets by night but which will beautify them by day.

From a simple problem, street lighting became one of the most complex facing the municipality, involving not only a study of the illuminating and artistic characteristics of the units, but also a very complete study of methods by which the system may be financed.

Owing to the higher cost of the so-called ornamental street-lighting systems, and the fact that street-lighting rates are more or less a fixed quantity, central stations ceased to take an active part in the promotion of modern street-lighting systems, and the burden fell on the shoulders of progressive citizens. Whiteways, designed to benefit some particular locality, were promoted by enterprising merchants, and, as a result, heterogeneous collections of more or less efficient and artistic street-lighting units became common.

With a realization of the undesirable character of many of these installations, municipal officials gradually awoke to the necessity of exercising supervision over whiteway installations and unifying them into a comprehensive plan of city zoning. This action, however, did not solve the question of financing, and there is still a divergence of opinion between experts as to the best manner in which this may be accomplished.

Since central stations, in many cases, are unwilling or backward in undertaking the financing of modern ornamental street-lighting systems, it would appear that the best way in which this problem may be handled is for the municipality to design a comprehensive street-lighting system covering the entire city, and one which may be extended to new sections as they are developed, without materially disturbing the existing system.

Suitable types of ornamental posts and equipment should be selected for various classes of streets and made standard throughout the city. In this way a flexible, well-balanced system may be designed which can be installed gradually as the necessary funds are provided.

In the writer's opinion, municipalities should own the street-lighting units and the underground distribution system and either purchase current in bulk from the public utility company, undertaking the maintenance of the system themselves or purchase current and mainte-

nance from the public utility company. In this way, the municipality is in complete control of the situation and can improve its system and increase the size of the units at will.

It should be recognized that the initial cost and maintenance, exclusive of current, of a modern street-lighting system varies but little with the size of the units, and that since current is the smallest part of the maintenance cost, the city with an arrangement as outlined above, can readily increase its street-lighting intensity as occasion requires without seriously increasing its annual maintenance expense.

Funds for financing street-lighting installations may be provided by bond issues, assessments or abutting property owners, or by voluntary subscription by the merchants in the district to be improved. If these methods are not possible, arrangements may be made with the public utility company to finance the installation and charge it off in the lighting rate, on a long-term contract.

In addition to designing a comprehensive street-lighting system, the municipality is responsible to the public for its adequate maintenance. As a legacy from the days of the arc lamp, city administrations generally keep a record of "outages" in order to collect penalties imposed under the terms of the street-lighting contract, although with modern street-lighting equipment, total outages are comparatively few. "Semi-outages," caused by dirty glassware or blackened lamps, generally pass unobserved, even though such outages are a greater factor in the efficiency and appearance of a street-lighting system than actual outages.. In considering maintenance charges on a street-lighting system, sufficient funds should be provided for frequent cleaning of glassware and lamps.

It is now generally recognized that modern traffic conditions require a high intensity of illumination in street lighting, and, since a high intensity means more and larger units, it is desirable that municipal officials when designing a street-lighting system should take advantage of the latest developments in light control and adopt the most efficient units.

The earlier developments in the control of light for street illumination involved the use of reflectors which conserved the upward light and added it to the downward light, increasing the illumination on the sidewalk and roadway adjacent to the unit. Later, prismatic refractors, totally or partially enclosing the light source, were developed which bent upward light toward the street surface. These devices, however, controlled the upward light only, and an equal amount of light was distributed on the horizontal plane in all directions around the units. This resulted in a condition with which we are familiar, viz., a brightly lighted area adjacent to the units and a darker area between. This is known as "symmetrical distribution."

With the modern practice of mounting street-lighting units on ornamental posts installed along the curb line it is very evident that units which produce symmetrical distribution are wasteful and unsatisfactory in the results obtained. Ornamental posts are spaced at distances varying from 50 to 30 ft., according to local requirements. It is obvious that under these conditions the distance the light must travel to illuminate the area between units is greater than the distance across the sidewalk or across the roadway. To produce an even illumination, with as much light between posts as is distributed on the street surface adjacent to the units, a light source producing unsymmetrical distribution is required.

The development of a device which would produce a symmetric distribution of illumination suitable for use in ornamental street-lighting units was announced in 1923 at Lake George, N. Y. when the equipment was demonstrated for the first time in public. Considerable interest was aroused, and it was generally conceded that the development of this device marked the greatest advance in the art of ornamental street lighting since the Mazda type C lamp was introduced.

This new device is known as the Bi-lux refractor. As its name implies, it produces a graduated distribution of luminous flux on the street surface by means of refracting prisms. The Bi-lux refractor is designed to build up two wide paths of light diverging in opposite directions up and down the street. This is accomplished by intercepting part of the light from the direction of the building, part from the direction across the road- 22½ degrees from the curb line toward luminous beams. The angle of maximum way, and then bending it into the main the roadway. The intensity is so graduated that an evenly distributed luminous

flux is "sprayed" on the street surface.

The Bi-lux refractor consists of two cylindrical elements of crystal glass, nested one within the other and clamped together so as to form a single unit which is the shape of a frustum of a hollow cone. A series of horizontal prisms on the inner element bend the light flux downward in the direction of the street surface, while a series of vertical prisms on the outer element bend the light rays into the two main 22½ degree beams. The minimum distribution is in the direction of the sidewalk at right angles to the curb line, while a slightly increased intensity is directed across the road in the opposite direction. The resultant illumination is evenly distributed with glare reduced to a minimum.

The light from a 4,000 lumen Mazda lamp is approximately equivalent to 2,000 cp. up and down the street, 425 cp. across the roadway and 225 cp. in the direction of the buildings.

The Bi-lux refractor controls practically all of the light from a lamp with the exception of a small portion of the upward illumination. This upward light, which is negligible compared with the total output of the lamp, may be redirected, if desired, by means of a specially designed reflector, or it may be utilized for illuminating the building fronts by equipping the lighting unit with a glass canopy. This is desirable in downtown streets to bring out the details of the architecture of important buildings.

Another interesting development in asymmetric units for ornamental street lighting has been made with octagonal lanterns equipped with refracting panels designed to produce results similar to those obtained with the Bi-lux refractor. In this case three of the panels toward the building side have the characteristics of reflectors, permitting a small amount of light to pass through, while the others are refracting panels which bend the light flux up and down the street.

The first ornamental street-lighting installation embodying this new principle of asymmetric distribution has been completed on Sheridan Road, Chicago, under the direction of the Commissioners of the North Shore Park District. This district comprises Rogers Park north of Devon Avenue. Owing to its location between the city and the prosperous North Shore towns, Sheridan Road, besides having considerable local traffic, is the main artery of travel north and south. The dense automobile traffic passing along Sheridan Road necessitated a high intensity of illumination, and after a careful study of the different types of modern street-lighting units the Commissioners decided to install the new asymmetric system. Since this part of Sheridan Road is largely residential, the canopies were equipped with upper reflectors to redirect downward the upward component of light, which otherwise is utilized for illuminating the building fronts The units are mounted on 14 ft. 6 in. high to light-center on Hollow-spun concrete posts which harmonize with the concrete posts installed on other sections of Sheridan Road. The posts, numbering 154, are spaced 120 ft. apart on both sides of the street opposite one another. The width of the paved roadway is 54 ft. and this installation runs for about 1¾ miles. The lamps are 6,000 lumen, 20 amp. Mazda C operated from 24 kva. constant-current regulating transformers installed in a substation adjacent to the installation.

Commenting editorially on the new lighting system, the Chicago Tribune said:

"A noteworthy bit of modern city improvement of immediate value to many Chicago residents and of potential value to all the rest is the new street-lighting system recently installed along the North Shore Park district. Walking or driving in these winter evenings out of the normal street lighting of Chicago into this section is almost like stepping from a darkened room into brilliant sunshine.

"The result is a street evenly illuminated, with equal visibility between the standards and immediately around them, no glare in the eyes of motorists and pedestrians, but ease, comfort and safety to all concerned."

Many cities have adopted the asymmetric system since the completion of the Sheridan Road installation in December 1923, the results obtained fully justifying the enterprise of the municipalities in adopting the latest practice in ornamental street lighting.

THE FEDERAL HIGHWAY AID PROCESS EXPLAINED

(Editor's Note: Many do not understand the workings of Federal Highway aid and to all such this article will be helpful. The attack on the principle makes the article timely. This article

uses Missouri as an example and was prepared as a highway short course discussion by B. H. Piepmeier, Chief Engineer of the Missouri State Highway Department.)

Federal aid is the money appropriated by Congress to aid the states in the construction of roads in accordance with the federal aid road laws. The money is appropriated from funds in the Treasury which are derived from general government revenue and not from any special sources, as in the case of state funds:

Federal Administration

The Bureau of Public Roads, a subdivision of the United States Department of Agriculture, administers the provisions of the Federal Aid Act. The Secretary of Agriculture distributes annually the Congressional road appropriations among the States as hereinafter described; his approval must be secured for all maps, statements, plans, specifications, estimates and major revisions relating to each federal aid project; he signs official documents and reports directly to Congress.

The Bureau of Public Roads maintains an office in Washington which corresponds to the State Highway Department office at Jefferson City. The duties of the administrative officials at Washington correspond with those of the bureau chiefs at the main office of the State Highway Department at Jefferson City. The United States is divided into thirteen districts corresponding to our ten state divisions and each federal district has a district engineer who reports to Washington, as our division engineers report to the main office. Missouri is in Federal District No. 5 and, with the exception of a few instances, all of our federal aid work is carried on through the office of District No. 5, at Omaha, Nebraska.

The Federal Aid Highway System

The mileage of road upon which federal aid can be used is limited to seven per cent of the total road mileage in the State. Of this seven per cent approximately three per cent is considered as primary, or interstate, in character. The minimum width of surfacing of these federal primary roads, as specified by the Federal Aid Act, is eighteen ft. The Secretary of Agriculture will, however, approve plans for federal primary roads using a narrower surfacing, provided the state certifies that the surfacing will be increased in the future, when traffic conditions make it necessary. The other four per cent of the federal aid system is known as the secondary or intercounty system.

The federal system of roads coincides with the state road system with but few exceptions. The federal primary or interstate routes have been selected. They do not necessarily coincide with the state primary system. The total mileage of the federal system is 7312 miles, of which 3255 miles are on the federal primary system. The total mileage of the state system is 7640 miles, of which 1545 miles are considered as the state primary system. The mileage of the federal primary system is more than double that of the state primary system.

Federal Aid Appropriations

Congressional appropriations of federal aid are made for each fiscal year. The fiscal year for the United States Government closes June 30.

Distribution of Federal Aid

The annual appropriation of federal aid to all the States varies between $50,000,000, and $75,000,000. The Secretary of Agriculture estimates the yearly administration expenses of the U. S. Bureau of Public Roads, and after deducting this estimated amount from the corresponding yearly appropriation he distributes the balance among the states as follows: —one-third in the ratio which the area of each state bears to the total area of all the states; one-third in the ratio which the population of each state bears to the total population of all the states; one-third in the ratio which the mileage of rural delivery routes and star routes in each state bears to the total mileage of rural delivery routes and star routes in all the states at the next preceding fiscal year.

By this method of distribution of federal aid among the various states, Missouri has been annually allotted funds varying from about $1,000,000 to about $3,400,000 with an approximate average of $2,400,000. The total allotment up to and including the fiscal year 1925 is $17,940,188. Unless each annual allotment is taken up before the close of the second succeeding year after it became available it is lost to the State.

Application of Federal Aid

Federal aid alone cannot be applied to the construction of a road. There must be at least a dollar from some other source to match every dollar of federal aid expended on a road. The maximum amount of federal aid which can be used per mile has been set by the Federal

Government. Until 1923 this maximum was $20,000 per mile, plus one-half the cost of bridges of more than 20 ft. clear span. In 1923 the maximum figure was reduced to $16,250 per mile, and in 1924 it was further reduced to $15,000 per mile plus one-half the cost of bridges of more than 20 ft. clear span.

Procedure For Making a Project Federal Aid

A. Project Statement. The preliminary step is the preparation of a general statement of the proposed route between certain limits. This statement, accompanied by a map, gives the location of the proposed project, the preliminary estimate of cost, and the names of any towns having a population greater than 2500. This statement is signed by the members of the Highway Commission and submitted to the Bureau of Public roads. A route inspection is then made jointly by representatives of the State Highway Commission and the Bureau. A complete report is prepared by the representative of the Bureau. When these documents are found satisfactory by the District Engineer, they are forwarded to Washington, with the District Engineer's recommendation for approval.

B. Plans, Specifications and Estimates. (P. S. & E.) The Standard Specifications for State Road and Bridge Construction are submitted to the Secretary of Agriculture and approved by him. After a project statement has been approved, detailed plans may be submitted to the District Engineer. The plans are accompanied by a detail estimate and a statement of the federal aid requested. In case of any special items not covered in the standard specifications, special provisions are also submitted with the plans. The plans, specifications and estimates are reviewed by the District Engineer and all computations checked. After everything is found to be in satisfactory condition, the documents are all forwarded to Washington with recommendation of the U. S. District Engineer, for approval.

C. Project Agreement. The Washington office again reviews all documents, and if everything is found satisfactory a special document known as the project agreement is prepared. This project agreement is a contract between the State and the Federal Bureau and sets forth the total estimated cost of the project and the amount of federal aid provided, together with other provisions relative to the porfomance of the work. The project agreement is then forwarded to the State and officially executed by the Highway Commission.

The project agreement is usually prepared on the basis of the engineer's estimate of quantities and prices. Any revision of plans and estimates must be submitted through the District Engineer to the Washington office. If the proposed revision is satisfactory, a modified project agreement is prepared and executed similar to the project agreement involving the new prices and conditions.

D. Advertisement and Contract. The project is advertised on the quantities appearing in the oringinal estimate forwarded to the District Engineer. It is not necessary to await the full execution of the project agreement to let the contract for the project, but it is a requirement that the plans for any project shall be found satisfactory for approval by the District Engineer before award of contract can be made. The work is advertised and awarded in the same manner as other state projects.

DATA ON ASPHALT CONCRETE PAVEMENTS IN VARIOUS CITIES

That asphaltic concrete street pavements, are now being laid to a much greater extent in cities throughout the country, is shown by investigations recently completed by the New York State Bureau of Municipal Information at Albany. This bureau has been looking into costs for street paving in American cities and has brought to light some very pertinent information. Altogether 57 cities reported having laid asphaltic concrete pavements since 1912 and having found them generally satisfactory.

Cities reporting mileages of asphaltic concrete pavements were as follows: Albany, N. Y., 3.42 miles; Akron, O., 40.45 miles; Canton, O., 0.68 miles; Charleston, S. C., 0.72 miles; Chicago, Ill., 110.71 miles; Camden, N. J., 5.75 miles; Denver, Colo., 28 miles; Detroit, Mich., 161.04 miles; Duluth, Minn., 0.05 miles; Dallas, Tex., 2.71 miles; El Paso, Tex., 0.5 miles; Fall River, Mass., 6.7 miles; Fulton, N. Y., 5. 9 miles; Fort Wayne, Ind., 55.23 miles; Fort Worth, Tex., 2.5 miles; Glens Falls, N. Y., 0.64 miles; Geneva, N. Y., 1.23 miles; Grand Rapids, Mich., 10.4 miles; Houston, Tex., 18.5 miles; Hart-

ford, Conn., 1.8 miles; Hudson, N. Y., 1.8 miles; Indianapolis, Ind., 98.76 miles; Kansas City, Kan., 8.96 miles; Kansas City, Mo., 14.27 miles; Knoxville, Tenn., 4.4 miles; Louisville, Ky., 4.22 miles; Mount Vernon, N. Y., 7.6 miles; Nashville, Tenn., 1.68 miles; Newark, N. J., 3.61 miles; Norfolk, Va., 10 miles; Borough of Queens, New York City, 109.9 miles; Borough of Manhattan, New York City, 0.8 miles; New Orleans, La., 4.49 miles; North Tonawanda, N. Y., 0.78 miles; Omaha, Neb., 77 miles; Oklahoma City, Okla., 10 miles; Pittsburgh, Pa., 4.13 miles; Portland, Ore., 34.9 miles; Peoria, Ill., 0.65 miles; Richmond, Va., 30.5 miles; Rochester, N. Y., 0.08 miles; Schnectady, N. Y., 25.5 miles; San Francisco, Calif., 38.6 miles; Salt Lake City, Utah, 9.99 miles; Syracuse, N. Y., 16.08 miles; Spokane, Wash., 3.76 miles; San Antonio, Tex., 9.3 miles; South Bend, Ind., 27.2 miles; St. Louis, Mo., 0.81 miles; Trenton, N. J., 17.8 miles; Tulsa-Okla., 95 miles; Tacoma, Wash., 6.27 miles; Utica, N. Y., 5.64 miles, and Wichita, Kans., 21 miles.

Charleston, S. C. reported maintenance costs for her asphaltic concrete pavements as "low," and Geneva, N. Y., reported pavements five years old with no cost whatever for maintenance to date. Hudson, N. Y. reported no maintenance costs on pavements laid in 1916. Oneonta, N. Y. also reported no cost for maintenance of 3,150 ft. of pavement laid in 1923. Portland, Ore., reported a maintenance cost of $0.008 per sq. yd. per year. San Antonio, Tex., gave her maintenance as 25 cents per sq. yd. per year while Wichita, Kan., reported maintenance at $0.002 per sq. yd. per year. Louisville, Ky., spent only about $4,644 per year for maintaining he entire mileage.

The following cities reported their pavements in good condition and as giving good service: Albany, Charleston, Denver, Dallas, El Paso, Fall River, Fulton, Geneva, Hartford, Knoxville, Kansas City, Mo., Louisville, Nashville, Newark, North Tonawanda, Omaha, Oklahoma City, Pittsburgh, Schenectady, San Francisco, Syracuse, Tacoma, Utica and Wichita.

Houston, Tex., Hudson, N. Y., and Mt. Vernon, N. Y., reported their pavements as "excellent" while Akron, Birmingham, Duluth, Norfolk, the Borough of Queens, New Orleans, Peoria, South Bend and Trenton reported theirs as in "fair" condition.

The following cities reported asphaltic concrete as having given "general satisfaction": Birmingham, Denver, Duluth, Dallas, El Paso, Fall River, Fulton, Fort Wayne, Fort Worth, Grand Rapids, Houston, Hartford, Indianapolis, Kansas City (Kan.), Knoxville, Kansas City (Mo.), Louisville, Mt. Vernon, Nashville, Newark, Borough of Queens, Now Orleans, North Tonawanda, Oneonta, Omaha, Oklahoma City, Pittsburg, Portland, Peoria, Schenectady, San Francisco, Syracuse, Spokane, Trenton, Tacoma, Utica and Wichita.

Akron, Canton, Charleston, Detroit, Glens Falls, Geneva and San Antonio reported some waves or cracks due to faulty construction. Fully 75 per cent of the asphaltic concrete in use in the cities is to be found on residential streets, although Canton, Denver, Houston, Indianapolis, Kansas City (Kan.), Knoxville, Mount Vernon, Norfolk, North Tonawanda, Oklahoma City, Pittsburg, Portland, Syracuse, Tacoma and Utica are using it on business streets or in the industrial districts. Base construction ranges all the way from a 3½ in. thickness in Denver to a 9 in. thickness in San Francisco. The prevailing thickness however is reported at 6 in., with a 2 in. surface.

Costs for construction per sq. yd., including wearing surface, base, cushion and binder course, but not including grading and curbing, were reported in the various cities as follows: Albany, $3.80; Akron, $3; Birmingham, $2.20; Canton, $2.60; Chicago, $2.95; Camden, $2.15; Denver, $2.25; Dallas, $2.90; Fulton, $2.30; Fort Wayne, $3; Geneva, $2.50 to $3.50; Houston, $3.10; Hudson, $3,27; Indianapolis, $2.65; Kansas City (Kan.), $2.95; Knoxville, $1.93; Kansas City (Mo.), $4.25; Louisville, $2.85; Nashville, $2; Norfolk, $2.50; Oneonta, $3.67; Omaha, $2.15; Oklahoma City, $3.70; Pittsburg, $3; Portland, $1.60; Peoria, $2.60; San Francisco, $2.52; Salt Lake City, $1.90; Syracuse, $2.30; Spokane, $1.50; South Bend, $2.60; St. Louis, $3.25; Tacoma, $2; Utica, $3.10, and Wichita, $2.40; Cleveland reported a cost of $1.50 per sq. yd. and the Borough of Queens reported $2.50 per sq. yd. for surface only. New Orleans reported a cost of $3.40 per sq. yd. including grading. The variance in costs is due to variance in labor costs and freight charges as well as those governing the sale of local materials such as stone, gravel and sand.

A peculiar thing about the results of the buearue's investigation is that not a city using the Topeka type of pavement reported a single objection to it. Each and everyone reported satisfaction with it. Denver has 30 miles of it; Lowell, Mass., 3.65 miles; Norfolk, Va., 2 miles; Portland, Ore., 20.95 miles; St. Paul, Minn., 47.2 miles; Spokane, Wash., 14.83 miles, and Worcester, Mass., 9.28 miles. The Borough of Manhattan, New York City, has 1.06 miles; Oklahoma City, Okla., 4.5 miles, and Poughkeepsie, N. Y., 1.5 miles. Construction costs for this type ranged from $2 per sq. yd. in Denver to $3.70 per sq. yd. in Oklahoma City. Poughkeepsie reported a cost of $2.68 per sq. yd., and St. Paul reported a cost of $3.10 per sq. yd., including grading. No maintenance costs were reported by any of the cities.

Kansas City, Mo., reported the largest mileage of bituminous macadam pavements. This city has 200 miles of that type. Chicago was next with 189.94 miles, followed by San Francisco with 184 miles, Borough of Queens, New York City, with 145.45 miles and Philadelphia with 136.78 miles. The 242.18 miles reported by St. Louis included an extensive mileage of Telford waterbound macadam.

Experience with bituminous macadam was generally satisfactory on account of its low first cost and light maintenance expense. The former ranged from 75 cents per sq. yd. in Richmond, Va., to $3.50 per sq. yd. in Batavia, N. Y., and the latter ranged from $0.015 per sq yd. per year in Gloversville, N. Y. to 10 cents per sq. yd. per year in Hudson, N. Y. Cambridge, Mass., reported first costs ranging from $1 to $1.75 per sq. yd., Denver reported $1.50 per sq. yd.; Dallas, $1.35 to $2.50; Fulton, $1.40 to $2; Kansas City, Mo., $2 to $2.50; Syracuse and Poughkeepsie, N. Y., Knoxville and Nashville, Tenn., and Lawrence, Mass., $2; Borough of Queens, $2.50; Borough of Brooklyn, $1.70; Oneonta, $2.15; Philadelphia, $2.60; Rensselaer, N. Y., $2.37; Sherrill, N. Y., $1.60; Spokane, Wash., $1.50; Utica, $1.35; Worcester, $1.75 and Wilkes Barre, Pa., $1.72. As in the case of the other types of paving, costs varied according to labor costs and transportation charges and the proximity of local materials.

SHOULD SHORT-HAUL FREIGHT PAY ITS OWN WAY?

By A. J. Brosseau, President Mack Trucks, Inc., 25 Broadway, New York, N. Y.

As I scan the transportation field, I see evidence of high expenditures in the purchase of the 17,500,000 motor vehicles now threading their way through crowded city streets and along the busy trunk lines of our highways.

Vast sums have been spent to build these highways to carry this new form of transportation.

There is a responsibility, a great responsibility to the public, to properly maintain and protect the investment in these highways, and there is also the obligation that we shall use them to their fullest extent in order that the funds so expended may return the largest possible dividends.

The situation of the other transportation agencies must be examined.

We must reckon with the investments that have been made in the steam and electric railways, and the service they have rendered, the service they can continue to render and the extent to which they can adopt the new agency.

Wastage in the form of uneconomic operation should be avoided. Sane regulation in the public interest should be asked; not frowned upon. A free and full discussion of every phase of the problem should be encouraged.

What Shall We Do About The Short Haul?

Until the days following the World War, the railroad was looked upon as the chief, often the only, medium for the transportation of commodities.

Horse drawn traffic was slow, strictly local and costly; consequently the rail lines were called upon to extend spurs and "feeders" from their main lines into every territory where there was a potential tonnage destined for the long haul.

From the very outset, many of these lines were not self-sustaining, but owed their existence either to the public demand for service, which compelled their construction, or to the fact that the profit on the long haul traffic so developed more than offset local losses.

No less an authority than L. F. Loree, President of the Delaware & Hudson Railroad, has estimated that 25,000 miles of these lines would never have been constructed had the motor vehicle been available.

Truck Able to Give Service Economically

The motor truck, unburdened by terminal expenses, packing and handling charges, and not subject to terminal delay, has been able to give a service which has taken over much of the short haul railroad freight traffic.

Meanwhile the railroad company, which never made a profit on this traffic (even when it handled all of it) is left in the position of being forced to continue operations at a loss. The result is vividly illustrated in the recent action of the Boston & Maine officials in applying for the right to abandon part of their mileage on the plea that 1,000 miles out of a system of about 3,000 miles returns only three per cent of the revenue.

What are we going to do with cases of this kind? The public demands a service which the railroad cannot economically supply and which the truck does give.

Shall the railroad be permitted to operate trucks and continue in the transportation business, or shall it abandon the field to the other carriers?

Or, are we going to continue to make the long haul pay the losses of the short haul by forcing a continuance of rail operation?

What Shall We Do About Our Terminals?

It is a significant fact that the lack of highways, which compelled the railroads to build branch and spur lines, made it necessary in the early days that their freight terminals be established at points immediately adjacent to the industries or consumers served. As a result of this practice, large sums have been expended in the erection of freight sheds in the heart of great industrial areas.

This property has become tremendously valuable, and yet, as transportation needs have grown, the railroad executives have frequently been forced to increase existing facilities until a large percentage of railroad capital is invested in terminals.

I have it on the authority of Charles C. McChord of the Interstate Commerce Commission that "At one freight station in Chicago, the interest charges on the real estate alone amount to more than $2.30 per ton of freight handled through that station."

Not only does this practice occur in the construction of the main terminals, but we find outlying stations built at strategic points within city limits until the area is dotted with stations which are principally used for intra-terminal movements.

The motor truck now comes into the picture, and according to the conclusions of rail and motor executives who comprised Committee IV of the Chamber of Commerce of the United States' National Transportation Conference, it is here that the vehicle can perform its greatest service.

Electric railroad operators claim that the street car is the best vehicle for mass transportation. It has its field and a useful one. Yet, like the railroads, when in competition with the trucks for the short haul traffic, the electric line cannot compete with the bus unless it goes into the bus business. If it does, and the field is open to all, unrestricted competition may bring about conditions which will force one or both agencies into bankruptcy and leave the community without the service which it has a right to demand.

The question of whether or not there shall be bus transportation has already been settled affirmatively by the public. We must, therefore, find an answer to these questions:

Shall we allow free and unrestricted competition between bus and street car companies?

Shall we have co-ordinated transportation in our cities under the proper regulation?

Shall we seek to segregate bus and street car traffic, that is, street cars on some streets, buses on others?

SOME PROPERTIES AND USES OF ALUMINATE CEMENT

By Roger L. Morrison, Associate Professor of Highway Engineering, University of Michigan, and Director Michigan State Highway Laboratory, Ann Arbor, Mich.

Aluminate cement is made from limestone and bauxite, the latter material being high in alumina and taking the place of the clay used in the manufacture of portland cement. The outstanding properties of this cement are the very high strength which it develops in 24 hours and its power to resist the chemical action of sea water and certain underground waters encountered in tunnels. It is also stated that aluminate cement is less affected by freezing temperatures before it has set up than is portland cement.

Both American and European chemists have been investigating the possibilities of aluminate cement for approximately

20 years but it was first developed upon a commercial scale by M. Jules Bied, Technical Director of Ancienne Societe J. & A. Pavin de La Farge, France, and is being manufactured by this company under the name of ciment fondu. Apparently the first use of this cement was on railway tunnel work but it was brought to the attention of many engineers during the war when it was used in artillery foundations and for other work at the front where speed was of great importance. It is also used extensively in pavement repairs, particularly in Paris, and the present production of the La Farge Company is about 200,000 barrels annually.

Probably the first experimenting in this country along the lines of the development of aluminate cement was by Mr. H. S. Spackman but nothing was done commercially until last year, when the manufacture of aluminate cement was begun by the Atlas Lumnite Cement Company. As this is the only aluminate cement made in the United States at present, the investigations now being conducted at the University of Michigan are necessarily confined to that product.

This investigation was not begun until the fall of 1924 so that our problem was to get as much information as possible in a short time. For this reason the tests are perhaps not as logically arranged, and are certainly not as complete, as they would be if the time had not been so limited.

The tests made to date (Feb., 1925) include chemical analysis, specific gravity, fineness, soundness, and setting time of the cement, tension and compression tests of cement mortar, compression tests of concrete, bond between aluminate and portland cement mortar, and setting time of mixtures of aluminate and portland cement. In most cases, check tests using portland cement were made at the same time and by the same operators, as a basis of comparison.

The most interesting property demonstrated by the tests is the very high strength attained by aluminate cement at 24 hours, the strength being greater that that of portland cement at 28 days. Maximum strength seems to be reached at from three to five days. The strength of the best 1:2:4 aluminate cement concrete at five days was almost exactly twice as great as the strength of the best 1:2:4 portland cement concrete at 29 days.

It is frequently stated that aluminate cement requires more water than portland cement, but the results of these tests are not in accord with that statement. The strength of the aluminate concrete was, in practically all cases, inversely proportional to the amount of water used. When the strengths are plotted, the curves representing the various slumps are approximately parallel lines, the greatest strength occuring with the use of the smallest amount of water. It took practically the same amount of water to produce a given slump with aluminate cement as with portland cement.

When the strength of the various mixes are plotted so as to show the relation between the strength and the percent of cement in the mix, the resulting curves are practically straight lines except for a break at the 1:2:3½ mix. This refers to the 24 hour strength only, as the investigation has not included sufficient tests, as yet, for the determination of these relationships at later periods. At 29 days a 1:4:8 aluminate cement concrete has about the same strength as a 1:3:6 portland cement concrete, while 1:3:6 aluminate is about as strong as 1:2:4 portland.

Absence of moisture during the curing period seems to have much less effect on aluminate cement than upon portland cement. In fact, in almost every case the cylinders cured in dry air were stronger than those cured in moist air, the average difference in strength being 7 percent.

In nearly all cases where the unit crushing strength was more than 4,000 lbs. the aggregate was fractured.

An important question when aluminate cement concrete is used in connection with portland cement concrete is the strength of the bond between the two materials. Six half-briquettes of portland cement mortar were replaced in the molds and the rest of the space filled with aluminate cement mortar. The new briquettes formed in this manner were broken at the end of 24 hours and showed bond strength of 280, 125, 325, 240, 95, and 190 lbs. per sq. in., or an average of 209 lbs. per sq. in. In one case, about half the fracture was through the old portland mortar instead of being all at the bond.

Many discussions of aluminate cement state that it cannot be mixed with portland cement without causing a flash set. Results of setting time tests made upon

such mixtures indicate that flash set does not occur unless the proportion of portland cement falls between 33 percent and 90 percent of the mixture.

The tentative conclusion to be drawn from this investigation is that the American aluminate cement, like the European product, is well adapted for use in highway work. *While its high cost (about three times that of portland cement) tends to limit its use* as a general constructive material, it seems to be well adapted for repair work and for use in situations where it is urgent that traffic delay be reduced to a minimum. It should be possible to open patches to traffic the day after they are placed, thus eliminating the inconvenience and great danger of barricades and the difficulty of keeping the patches moist during curing. Apparently there would be no difficulty in obtaining a secure bond between the patch and the old pavement. Several state highway departments have constructed experimental sections of aluminate cement concrete pavement and opened them to heavy traffic the following day without serious injury.

Before final conclusions can be drawn it will be necessary to make long time strength tests, abrasion tests, modulus of rupture tests, etc., and in the meantime the opportunities for observing the behavior of this material under actual service conditions are constantly increasing.

The writer wishes to express his thanks to Messrs. H. S. Spackman, P. H. Bates, Edwin C. Eckel, and to several other American and French engineers who have studied and used aluminate cement, for the valuable information and suggestions which they have given him, to Mr. M. H. McGaffigan for making the chemical analysis, and to the manufacturer for supplying the cement used in the investigation. The hearty co-operation of Professor A. H. Blanchard, the officials of the Michigan State Highway Department, and the State Highway Laboratory staff has made this investigation possible.

The foregoing is from a paper by Prof. Morrison before the Eleventh Annual Conference on Highway Engineering at the University of Michigan, Ann Arbor, Feb. 18, 1925. The full paper contained numerous tabulations of test data which could not be reproduced here.

TRUCK TIRE TESTS BY U. S. ROAD BUREAU

By E. B. Smith, Engineer of Tests, U. S. Bureau of Public Roads, Washington, D. C.

[Editor's Note: The following article is from the August, 1925, number of "Public Roads," issued by the U. S. Bureau of Public Roads.]

During the past two years the Bureau of Public Roads has been carrying on a series of tests to determine the relative cushioning properties of solid rubber, cushion and pneumatic truck tires. This information is of vital interest to truck manufacturers because it may suggest a method for reducing the force of the shocks transmitted to the mechanism and thereby lengthen the life of the truck. The truck user is also benefited by any improvement which tends to decrease the annual operating costs of the truck. Truck manufacturers and users, however, representing only a small fraction of the population, are not the only beneficiaries, since the tests also provide data relative to the destructive effect of the different types of tires on the road surfaces which are built at the expense of the public.

When and by Whom Tests Were Initiated

The tests were initiated about two years ago by representatives of the Bureau of Public Roads in conference with representatives of the various tire and truck manufacturers. A co-operative committee was chosen to prepare a preliminary outline of a series of tests which would furnish useful information relative to tires, trucks and road surfaces. This co-operative committee represented the Bureau of Public Roads, the Society of Automotive Engineers and the Rubber Association of America. The rather extensive series of tests which were outlined included the use of different trucks, most of the representative tires of different types and sizes (necessitating several hundred tire changes), and the constant employment of 8 to 10 men. It was expected that the series would extend over a period of more than three years.

The Bureau of Public Roads is conducting these tests at the Arlington Experiment Station, near Washington, D. C., and is providing all the personnel, testing facilities, apparatus and instruments. The other co-operating agencies are furnishing all the tires, extra wheels and trucks. After the tests were begun many unforeseen duplications were eliminated and the time of the investigation was considerably reduced. Present estimates

indicate that this series of tests, which has been in progress less than two years, will be completed probably next fall, at least so far as the experimental work is concerned.

In stating the facts to be determined by these investigations no one object can be selected as the most important. The principal factors involved are of course the cushioning qualities of various types of tires and the relative impact they deliver to road surfaces. However, these primary factors are influenced by variations in the sprung and unsprung loads, the speed, the temperature, the condition and kind of tire, and the roughness of the road surface. These variations necessitate principally tests under impact conditions, but for each tire a static-load test is also made. In securing the data sufficient information is also obtained to determine the force delivered to road surfaces by both impact and static loads. It is possible that a careful compilation of the data will reveal a short and accurate test for classifying tires.

Although these tests are not finished, some of the preliminary indications have been already of real service to the automotive industry and improvements have resulted. Furthermore, the series is developing information which will be of value in the formulation of traffic rules and regulations.

Trend of Results

At this time it is not proper to publish any of the detailed numerical data which have been obtained, although it should be of interest, in a general way, to indicate the trend of the results.

It is found that the magnitude of the deceleration of a truck wheel may be as high as 2,500 feet per second, as in the case of a badly worn tire. In some cases this may produce an impact force equivalent to 15 times the static load. This, however, is a very extreme condition, rarely found in actual practice. It corresponds to a truck carrying a load of 5 tons and with little or no rubber on the steel wheel rim.

Wide tires give higher impact forces than narrow tires for the same load. This does not mean that narrow tires should be used in preference to wide tires in order to prevent the destruction of road surfaces. On the contrary, tires should not be reduced in width beyond a load of 800 pounds per inch of width for wide tires and 600 pounds per inch of width for smaller tires (less than 5 inches in width) on account of the possibility of causing ruts in rock and asphalt roads and the further possibility of reducing the mileage service of the tire.

The vertical thickness of rubber available for cushioning in solid and cushion tires is a very important factor. An ordinarily worn tire may deliver an impact blow as great as seven times the static load of the same tire.

An unevenly worn or damaged tire may easily produce a force equivalent to that of a very rough road both in the impact the road surface will be subjected to and the equal and opposite shocks which will be transmitted to the truck.

On smooth pavements it is self-evident that the cushioning qualities of tires and the impact forces developed by traffic are of small value and consequence and not capable of being measured. Only on rough and wavy pavements do these qualities and force factors become of sufficient magnitude to be measured.

Brief Description of Impact Tests

The impact test consists in operating a truck equipped with test tires over representative sections of smooth concrete and rough granite-block roads, and over a series of artificial obstructions securely anchored to another section of smooth concrete road. These artificial obstructions consist of inclined planes, rectangular and rounded blocks of varying heights. The impact is determined both on striking these obstructions and at the instant the wheel hits the ground on the first rebound. Sufficient variations in speed are made to determine a reliable curve and the truckload is varied from a condition of emptiness to such an amount that the tires will be overloaded 50 per cent. The determination of the total impact force is made by measuring the deceleration of a rear wheel and the deflection of the corresponding truck spring at the instant of impact.

The deceleration of the rear wheel is measured by a specially designed accelerometer. This instrument is mounted on the side of the truck body, although it obtains its motion through a rigid vertical rod extending down and connecting to the hub cap. The connection to the hub cap is made by means of a specially constructed, tight-fitting universal ball bearing. The deceleration is measured with this accelerometer by virtue of a small weight supported on a calibrated spring. A record is made on the moving paper tape by means of a pencil attached to the decelerometer weight. The verti-

cal height of the record indicates the deceleration according to a scale, which depends upon the spring used under the accelerometer weight, and the cushioning qualities of the tire under test are indicated by the vertical height of the record. The horizontal scale of the record represents the position on the road. In this way the acceleration of the truck wheel may be accurately and definitely located on the record for any position on the road surface. On this same paper tape a record is also made by means of a special attachment between the rear axle and the body, showing the deflection of the truck spring at any instant. Before testing, all truck springs are removed, cleaned and greased, and are kept in this condition by being covered with a canvas boot. These springs are carefully calibrated for load and deflection under a testing machine. The total force delivered to the road surface is then the impact as determined from the deceleration and mass of the rear wheel (unsprung weight) plus the sprung weight as determined by the position of the truck spring at the same instant.

Relation of Impact to Static Loads

Each tire was subjected to a static-load test in a testing machine in which the load and deflection were recorded for several conditions of loading up to about 500 per cent. overload and tire imprints or areas of contact were obtained. Although there is sometimes an indication of a relation between static and impact tests, a definite relation has not yet been established which can be applied to all tires for the purpose of predicting from the results of the static tests what the action will be under different conditions of impact.

The cushioning quality of a tire is measured by means of the accelerometer and has a direct relation to the deceleration resulting when the tire strikes the road surface with a given velocity. Undoubtedly the tire which offers the best cushioning qualities is one which will give the lowest deceleration value under the condition of impact. In other words, the tire which will cause the wheel to come to rest (in its vertical motion) in a greater distance will have a smaller deceleration value and consequently better cushioning qualities. These cushioning qualities of the different tires are dependent not only upon their inherent characteristics, but also to some extent on the character of the obstruction which they may strike. The horizontal speed with which the truck wheel strikes an obstruction or irregularity in the road surface and the load which it carries are also influencing factors. The cushioning quality of any particular tire is affected also to some extent by the tire temperature.

The cushioning quality of the tires as influenced by the tire temperature was carefully determined by mounting the tire on a truck wheel and placing it in a special impact machine wherein the tire was raised and dropped in a vertical position from different heights. The resulting deceleration was measured with an accelerometer. The temperatures were obtained by means of a water bath and electric heating units. The tire temperature was measured by means of thermocouples thrust into the body of the rubber composition, the temperature being varied from about 30 degs. F. to 210 degs. F. The results of these tests showed that the cushioning qualities were greater for hot tires than for cold tires and that the variation of cushioning with respect to the temperature was rectilinear.

Character of Road Surfaces

The road runs of these truck-tire tests were always over the same selected stretches of different types of roads, and, as far as possible, the truck wheels always followed the same line on the pavement. This resulted in a very good comparison. The two principal types of road surface used were a reasonably smooth concrete and a fairly rough granite (Belgian) block pavement. At the beginning of the tests a bituminous concrete road section was also used, but it was discovered in a short time that this changed in surface roughness to such an extent that successive comparisons could not be depended upon, and it was therefore eliminated.

The different types and sizes of trucks used in this series of tests included a 2-ton worm-drive Mack, a 3-ton Autocar, a 1-ton Ford with special gear reduction, a standard 5-ton class B army truck, and a 6-wheel type 5-ton army truck. These trucks all had additional wheel equipment whereby most of them could be equipped with solid, cushion or pneumatic tires. The speed of operation varied from about 3 miles an hour to the maximum of which each particular truck was capable under the test conditions. None of the trucks exceeded a speed of 30 miles an hour.

PAVING STREET RAILWAY TRACKS

By Julius Adler, Deputy Chief, Philadelphia Bureau of Highways, City Hall, Philadelphia, Pa.

It is usual to speak of "paving problems" adjacent to railway tracks, though actually there is just one problem: that of attempting to adjust the differences in behavior of two totally dissimilar structures—the street paving and the track structure—laid side by side (overlapping, in fact), and designed to furnish quite different forms of service. Contact with the actual work of paving construction and maintenance adjacent to tracks makes it appear that there are quite a number of distinct problems, which, nevertheless, may all be traced to the same source.

The progress which has been made toward the solution of this problem is quite slow. The reason for this is, at least in part, the fact that the street railway engineer is interested primarily in constructing a track which from the standpoint of first cost, yearly upkeep, and total life, will prove most economical to the railway company. To a less extent, the engineer or city official is at fault for not attempting to devise or adopt new forms of paving which are better calculated to resist the disturbances created along the rails, and which are also better adapted to the making of necessary repairs to the track structure.

Allocation of Cost

The practice of requiring the street railway company either to pay the original cost, or to do the actual work of paving between and adjacent to rails, and to make all ordinary repairs thereafter, is quite general throughout the country. The arrangement existing in Philadelphia whereby the traction company is relieved of the obligation of original paving and repairs in the track area in return for a flat cash payment each year, is apparently peculiar to this City. If it is conceded at the outset that the railway track is the disturbance-producing factor, then the first described arrangement appears on the face of it to be an ideal one. The transportation company, which places both the track and the original pavement, must either use the most substantial track construction possible or pay the penalty in the form of increased cost of paving maintenance. In contrast with this situation in Phildelphia, the City has no control whatever over the track construction but must, in return for a fixed cash payment, assume the entire burden of keeping up the pavement adjacent to the rails which are the primary cause of later defects. In actual practice, however, it does not by any means follow that track paving conditions in cities of the former class are invariably better than in Philadelphia and the fact that such is the case gives a good idea of the real difficulty of the track paving problem.

Problem Along Straight Tracks

Consideration of the track and paving problem begins with conditions along straight rails. Continued study of this part of the situation fails to lead to any other conclusion than that an elastic, free-moving track structure means destruction to the adjacent pavement, and that if elasticity or flexibility is a fundamental of successful track construction, then some means must be found to make the amount of this movement very minut in the beginning and to prevent it from increasing steadily thereafter.

Fortunately all progressive transportation companies are interested in developing more durable straight track construction, which naturally results in more satisfactory paving conditions. The point which remains to be determined is whether that interest will ultimately lead to a form of construction which will be regarded as the best available from the standpoint of paving results as well as track economy.

Several years ago, the American Society for Municipal Improvements appointed a committee which after a very thorough study of track and paving practice throughout the country, finally prepared a set of specifications dealing principally with straight track. Beginning with the track foundation, these specifications recognize the possibility of ballast consisting of such material as cinders, or natural gravelly soil and ranging through gravel and slag or crushed stone to concrete sub-ballast, that is, concrete below the bottom of the ties; and finally, solid concrete construction, wherein concrete is poured continuously from a level six to eight inches below the bottom of the ties, around the ties, and up to the proper surface for paving. Other things being equal, the difference in strength between these various forms of construction would be tremendous.

(Of these several types of track foundation construction, it is our conclusion that rock ballast and concrete slab (con-

crete sub-ballast) are the necessary forms for clay or other unfavorable soil conditions, accompanied by heavy car movements. The solid concrete construction is believed to be open to the railway engineer's critcism of excessive rigidity, promoting wear on the rails and leading ultimately to corresponding defects in the pavement. It furthermore makes repairs or replacement of rail structure excessively difficult and necessitates the removal of the entire bed of concrete whenever the rails and ties require renewal.)

These specifications also cover three distinct types of rail joint, and under one of these, the welded joint, five variations are named. Three or four different forms of rail are named, without any specific reference to the weight of the rail, and tie spacing is fixed at 22 to 30 in.

The committee evidently believed that with the wide divergence in conditions to be met in different localities it was inadvisable, if not impossible, to formulate a definite specification. In consequence the results of their work are valuable only in so far as the specifications may be interpreted and applied by intelligent and fair-minded persons. This, then, is the general situation which still exists with reference to straight track construction throughout the country:—There is no definite set of standards which have been formulated or agreed upon as representing the most approved forms of construction corresponding to certain sets of conditions.

At this point it is appropriate to point out that Philadelphia standard track construction has never included the use of stone or concrete ballast underneath the ties on straight track. In other respects the local standards providing a very heavy, deep, girder rail, and close tie spacing, are equal to, if not superior to those of many other cities, but it is a question of the greatest importance whether this compensates for the lack of additional support to the track structure.

Paving at Crossings and "Special" Points

In general there is much greater difficulty in maintaining satisfactory paving adjacent to crossings or other special track work, than adjacent to straight rail; in fact, *if it were decided to attempt a piecemeal solution of the general track and paving problem th efirst point of attack should be at crossings and special work; the second, at rail joints; and the third, along the remaining or intermediate sections of rail.*

At crossings and other special work the tracks are subjected to an amount of impact and general rough usage which are encountered nowhere else, and the adjacent paving suffers accordingly. Rail joints are naturally weak points in the track construction, and the least inequality or imperfection results in wear and impact which increase with continued use.

In 1922, the local traction company adopted as its standard, "flange-bearing" rails at crossings, the depth of the rail groove decreasing gradually from a point several feet away from the crossing to the crossing point so that the wheel rides on the flange in the groove. So long as the groove does not increase in depth until the weight is again carried by the tire resting on the head of the rail, or until unequal wear develops in the two grooves crossing one another, impact at the crossing point is eliminated. Any form of construction which is designed to reduce impact at the crossing is necessarily a great improvement over the previous type of crossing where a terriffic blow is delivered to the track by each wheel, but it would be rash to state that paving troubles at crossings will be completely eliminated by this improvement.

Experimental Construction

As stated in the beginning, a responsibility also rests with the paving engineer to develop forms of paving best adapted to resist the unavoidable disturbance which must be expected along the rails. In Philadelphia we have abandoned the use of everything but granite block as standard paving between and adjacent to rails. We have laid numerous sections of block with bituminous mastic—generally asphalt—filler to determine the benefits fro man elastic and water-proof joint filler. On 13th street between Locust and Pine streets, the transit company installed in 1923 a section of rock-ballasted track, including one crossing, in conjuiction with granite block repaving, for purposes of comparison with unballasted work. In the same year, the City installed concrete sub-ballast 6 ins. in thickness under crossings and adjacent straight track at 13th and Girard avenue. The experimental use of large granite slabs, or tram stones to block in all of the rails at a crossing, the first example of which is to be installed at 15th and Lehigh avenue. The purpose

of this, briefly stated, is to determine the improvement resulting from substituting paving units of greatly increased size, and correspondingly greater bearing area, for the relatively small units of granite paving blocks which are quickly disturbed by any movement in the adjacent track structure. Other innovations involving both the paving and the character of channel filler or rail plaster, are receiving further consideration and from one or all of these it is to be hoped that a substantial improvement in paving conditions will be effected.

The foregoing article by Mr. Adler is from the August, 1925, issue of "Engineers and Engineering," the journal of the Engineers' Club of Philadelphia.

PRESS COMMENT ON FEDERAL HIGHWAY AID

No Charity About Federal Road Aid

(From the San Francisco Chronicle)

Federal aid for Western highways is not a gratuity as some Eastern politicians are declaiming. It is in effect a repayment to the Western States of money properly belonging to them.

These Western States have a call on the Federal Treasury because the National Govenment owns millions of acres of lands in their boundaries on which it pays no taxes and from which the States in which these lands are included receive no revenue.

These lands are alike the property of New York, Pennsylvania or Ohio as they are the property of Utah, Nevada or California. They have been withdrawn and are held in reserve by the Nation. And because the States in which these lands are located are required to sacrifice the income that might be raised by taxation they are in that measure poorer.

The national parks and forest reserves included in these reservations are the pleasure grounds of the whole Nation. Millions yearly cross the continent to enjoy their beauties. The automobile is the usual instrument of travel. But without Federal aid it would be impossible to provide those fine roads modern necessity and convenience demand. The Government owes this assistance, and the clamor of Eastern States, where the Government owns no such public lands, should not be able to work a change in the policy of Federal aid to those States where it is needed.

Federal aid means that a Nationwide system of highways reaching to every part of the country will eventually be built. It means the linking of the States in a continuous chain of highways. Not only is such system desirable for military reasons but it serves a fine purpose in unifying and nationalizing all our people.

We cannot stress too strongly that this Federal aid is not a subsidy. It is merely paying back to the States a portion of that revenue they would be receiving if the public lands were paying taxes like other property.

Road Aid Not Pork

(From the Minneapolis Journal)

That Federal road money is in no sense "pork," has been demonstrated in the case of the State of Kansas. The Federal Government, as everybody knows, matches dollars with the States in the building and improvement of through highways that serve national needs.

The last Kansas Legislature seemed to think this money was some sort of a government gift, carrying no strings whatever. It failed to finance and equip the State Highway Department as required by the law as a prerequisite for Federal aid. Washington's action was prompt and efficacious. Last April Federal aid was abruptly withdrawn. Allotments of a million and a half dollars for the present fiscal year, and more than two millions for the succeeding fiscal year, were involved.

Now Kansas sincerely wanted better roads and was ready honestly to match its money with the Government's. But the Legislature, in a spirit of short-sighted parsimony, had hamstrung the Highway Department. The rather drastic Federal action got quick results. Legislators saw their error, regretted it, and were willing to correct it. But a way out was found that obviated a special session. The banks agreed to come to the rescue with loans to finance highway supervision that will be satisfactory to the Washington authorities this year and next. The banks are satisfied that the Legislature to be elected next year will do no quibbling about appropriating money to repay the loans—aggregating some three hundred thousand dollars—and to finance the Highway Department on a proper scale in 1927 and 1928.

It is a foregone conclusion that Kansas, with this lesson of 1925 in mind will not let the slip occur again. Nor will the lesson be lost on other States.

GAS TAX NOW EFFECTIVE IN 44 STATES

When the State of Oregon originated the gasoline tax plan in 1919 it was considered quite a novelty. Today it is effective in forty-four states and the District of Columbia. Oregon started with a collection of one cent a gallon. South Carolina has raised the rate to five cents a gallon. Three states—Arkansas, Nevada and North Carolina—have a rate of four cents. Utah has gone to three and a half cents and thirteen states now collect a tax of three cents a gallon, Oregon being one of them.

The California legislature raised the rate to three cents at the last session but Governor Richardson vetoed the bill, so California remains in the list having a two-cent gas tax.

Only four of the thirty-six states with a gasoline tax have held the rate down to one cent a gallon.

The states which have not adopted this plan for highway building and maintenance are New York, Massachusetts, New Jersey and Illinois.

Only thirty-six states and the District of Columbia collected a tax on gasoline last year yet the sum of $79,734,490 was raised. As eight more states are using the plan this year, many with higher rates, and as the consumption of gasoline is showing an enormous increase it is plain that a considerable sum will be collected during 1925 for highway purposes.

SUNSET, in its July issue, explained that the gas tax had made toll roads of the highways, the tax not being an impost on a commodity but a levy for the privilege of traveling by motor car. On this basis Henry R. Trumbower, economist of the U. S. Bureau of Public Roads, has worked out a schedule for comparison with former toll rates. In the July number of "American Review of Reviews," he says:

"If we assume 6,000 miles as the average annual motor vehicle mileage and 440 gallons as the average gasoline consumption per vehicle, the following toll rates per mile result:

Gasoline Tax Rate	Toll Rate Per Mile
1 cent	0.073 cents
2 cents	.147 cents
3 cents	.220 cents
4 cents	.294 cents
5 cents	.367 cents

"A 3-cent gasoline tax will, according to these assumptions, mean a toll rate of less than a quarter-cent per mile, or a 5 cent tax will result in a toll rate of slightly over a third of a cent per vehicle mile. It is interesting to compare these gasoline tax rates reduced to a toll basis with some of the toll charges which motorists formerly had to pay on toll roads and turnpikes. On six different turnpikes in Virginia and Maryland only a few years ago tolls amounting to $5.05 were charged for a total distance of 187.5 miles, equivalent to 2.7 cents per mile. If a state attempted to charge this same rate for the use of the public highways by automobiles, it would have to establish a gasoline tax of 36 cents per gallon, assuming the same mileage and gasoline consumption as in the foregoing analysis."

NEW DEVELOPMENTS IN THE AMERICAN ASSOCIATION OF ENGINEERS

Revision of the basic structure of the American Association of Engineers in accordance with the demands of the members as expressed in a recent referendum was the outstanding result of a meeting of the Board of Directors at Chicago on September 12. A referendum of the membership resulted in a vote of more than four to one in favor of separating national and local dues in the organization and other questions designed to reduce operating costs and promote a maximum of self government and efficiency within the organization.

Another basic change was in the elimination of grades of membership as used by technical societies which grades, in the judgment of the board, were not suited for a professional organization devoted to engineering welfare work such as the American Association of Engineers. Three classes of members are now provided for: Member and Affiliate with dues at $7.50 per annum each, and Junior Member (which includes former Student Members) at $2.00.

The new program contemplates a nation wide survey of the supply and demand of engineers to be carried on in cooperation with other national bodies; an enlarged placement service for engineering employees with district offices in various cities is also contemplated.

In order to emphasize the importance of the ethical spirit in the professional practice of the engineer a "Vow of service" will be devised to be used in graduating exercises at engineering colleges and in the admission of engineers to professional societies.

Above: East River Drive, Olean, N. Y. "Tarvia-X", 1922.

Lower right: Road gang widening old pavement with "Tarvia K-P" mix.

Upper Left: Grand Concourse and Boulevard, New York City. "Tarvia-B" since 1911.

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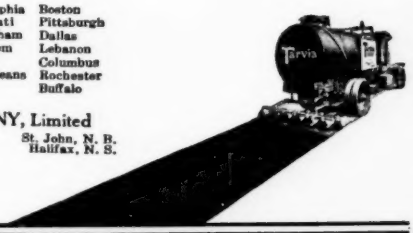
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